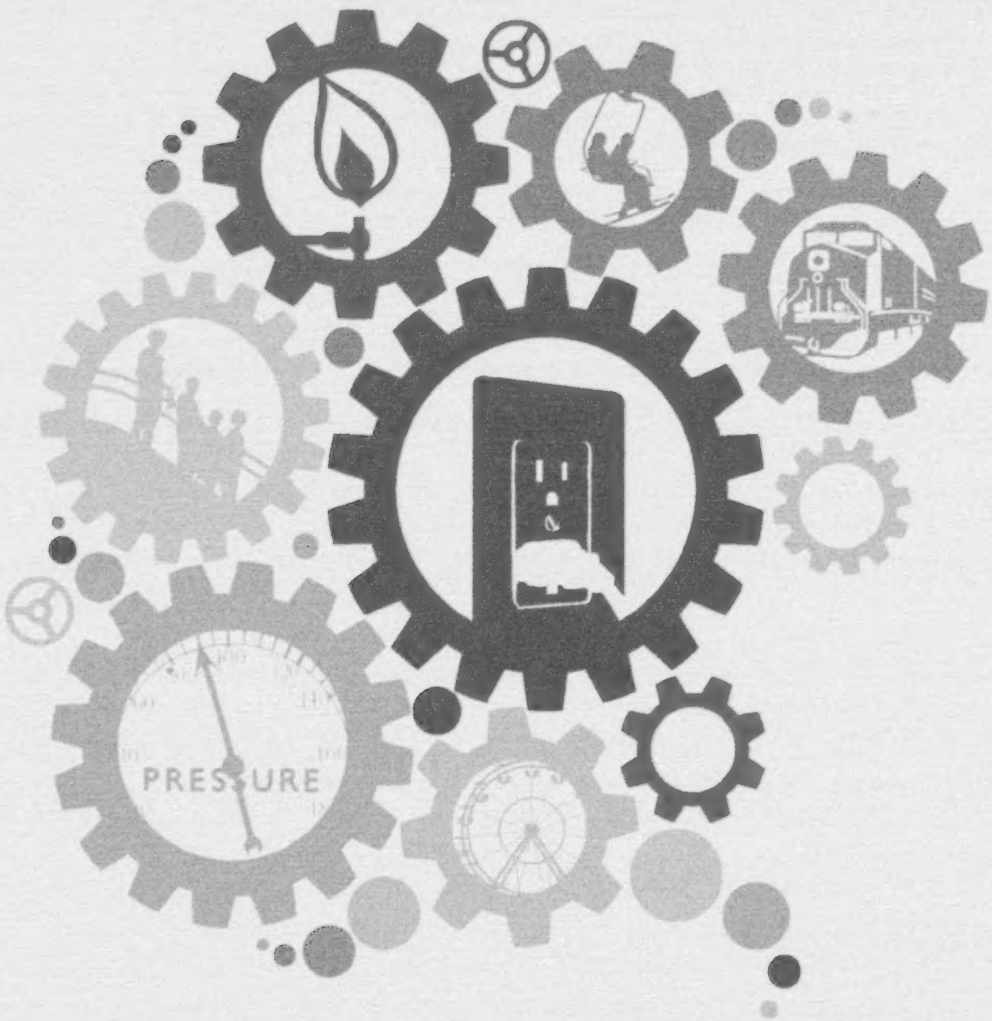
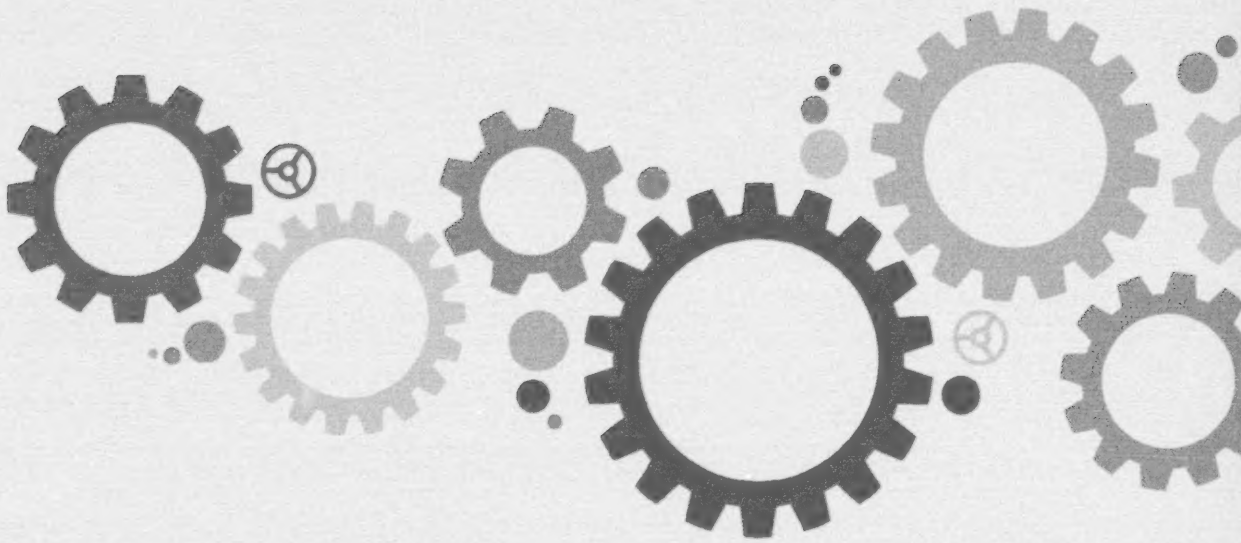
BC Safety Authority

Safety Authority

State of Safety Report 2014



Safe technical systems. Everywhere.



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Message from the Chair

I am pleased to present the 2014 State of Safety Report, which documents BC Safety Authority (BCSA)'s efforts in overseeing the safety of regulated technical systems and equipment in our province. This report summarizes a year of data collection and analysis, helping us and our network of equipment owners, licensed contractors and certified workers to understand safety trends and apply knowledge to areas of shifting risk.

We work in a safety system that involves people, equipment, safety standards, and work practices. It is a system that continuously evolves with new technologies and processes. This report highlights the importance of BCSA's increasingly knowledge-based and risk-focused approach to safety services.

By sharing with you all the data we have gathered, and more importantly, our analysis, we work with safety system participants to build an objective evaluation of and solid confidence in the system. We encourage you to read this report in its entirety and its quarterly updates on our website. To gain a long-term perspective of how we intend to advance technical safety, we also invite you to read our 2015-2017 Business Plan.

I would like to thank our stakeholders and clients for their strong participation in the safety system, and my fellow directors for their support and counsel in providing governance to BCSA as I fulfilled my first year as Chair of the Board. In addition, I would like to extend my appreciation to the executive team and BCSA employees for their professionalism, expertise and dedication in overseeing the integrity of British Columbia's safety system.

Richard Ballantyne
Chair of the Board

Message from the President and Chief Executive Officer

The 2014 State of Safety Report is built on installation and operating assessments and incident investigations performed by BC Safety Authority (BCSA) on regulated technical equipment and systems across British Columbia. The content depicts a year in review, providing relevant input for analyses. We encourage industry and the public to use the information contained in this report to inform decisions and create useful knowledge with regard to technical safety risk and/or other valued applications.

In 2014, BCSA collected information from a variety of sources, conducting nearly 35,000 physical assessments, investigating almost 500 reported incidents, and engaging with numerous stakeholder consulting committees. We also rolled out the first phase of a standardized "as found" system for recording hazards found during physical assessments and audits of regulated work and equipment. This program is already proving to be effective at identifying and correcting unwanted hazards before they materialize into potentially serious incidents. We share these insights with clients to reinforce safety knowledge overall.

In this report, we include longer-term trend information on specific types of incidents. It is important that collectively we learn and remain sensitive to the nature of risks they explore. These include:

- Ammonia Release Incidents (2007 to 2013);
- Carbon Monoxide Incidents (2007 to 2013); and,
- Deropement Incidents (January 2009 to June 2014). Deropements refer to situations wherein a cable of a passenger ropeway (such as a gondola or chairlift) comes off its normal running position.

We also share insights into some of our actions taken in overseeing technical systems safety in 2014:

- An investigation into the February 2014 Sea-To-Sky gondola incident in Squamish where an empty cabin fell to the ground after becoming detached from its cable.
- An investigation into the March 2014 Crystal Mountain Resort incident near Kelowna involving the full deropement of a chairlift where three chairs struck the snow, two of them carrying passengers.
- The implementation of the Elevating Devices Mechanics Certification Program, which establishes consistent certification standards for the industry and requires elevating device mechanics to complete a specified combination of education, training and continuing professional development.

I encourage feedback and comment on BCSA's 2014 State of Safety Report as we work to advance the understanding and prevention of safety risks.

Catherine Roome, P. Eng. FEC ICD.D
President and Chief Executive Officer

About BC Safety Authority

Our Vision:

Safe technical systems. Everywhere.

BC Safety Authority (BCSA) is an independent, self-funded organization mandated to oversee the safe installation and operation of technical systems and equipment. In addition to issuing permits, licences and certificates, we work with industry to reduce safety risks through assessment, education and outreach, enforcement, and research.

What We Do

We deliver safety services across the following technologies in the province:

- Electrical equipment and systems
- Boilers, pressure vessels and refrigeration systems
- Natural gas and propane appliances and systems, including hydrogen
- Elevating devices, such as elevators and escalators
- Railways, including commuter rail
- Passenger ropeways, such as aerial trams and ski lifts
- Amusement devices
- Complex and integrated technical systems involving multiple technologies.

Our Services

In order to promote safe practices, our services include:

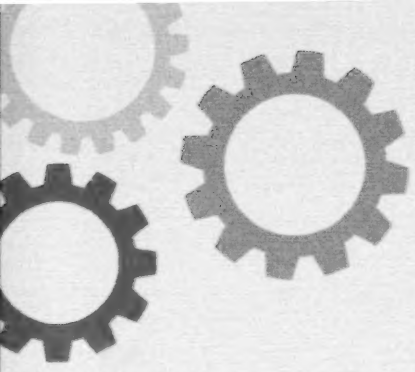
- Assessing technical work and equipment, including collecting information through physical assessment, incident investigation and registering new equipment and designs.
- Certifying individuals and licensing contractors and operators to perform regulated work.
- Supporting clients in the development of alternative safety approaches, and auditing their safety management plans or equivalent standards approaches.
- Taking enforcement actions that promote an equitable safety system where all participants are compliant with regulations.
- Educating our clients and the public about technical safety to better control risks.
- Conducting research, including contributing to provincial and national code development and updating regulations for the technologies we serve.

Our Legislative and Regulatory Framework

We operate within a legislative and regulatory framework that includes:

- *Safety Authority Act*
- *Safety Standards Act and regulations*
- *British Columbia Railway Act, Railway Safety Act and regulations*
- *Administrative Tribunals Act*
- *Freedom of Information and Protection of Privacy Act*
- *Ombudsperson Act*
- *Offence Act*

For further information, including our 10-Year Strategy, Annual Report, and Business Plan, please visit our website at www.safetyauthority.ca.



About the State of Safety Report

Our Mission:

We build your confidence in safety systems for life – through a focus on risk and support for innovation.

BC Safety Authority (BCSA) receives reports of incidents and conducts assessments of regulated equipment and work[1]. Through investigation and assessment, BCSA advances the knowledge of safety risks and focuses attention toward managing those risks.

The 2014 State of Safety report is the eleventh publication of its kind from BCSA. In accordance with the administrative agreement between the Province of British Columbia and BCSA, the State of Safety report provides:

- Analysis of incident and injury trends in all sectors regulated by BCSA.
- Explanations for incident and injury trends, particularly significant deviations.
- Comparisons, where possible, between BC incidents and those of other jurisdictions.
- Responses to information gathered from investigations, including understanding causes and taking necessary action to resolve systemic problems.
- A summary of risk-reduction initiatives and safety services to educate and communicate with the general public, clients and stakeholders of BCSA.
- A summary of national committees and inter-provincial working groups where BCSA has participated and provided leadership.
- A listing of enforcement actions taken by BCSA.

This report is organized into two main sections. Each section aims to provide an understanding of safety hazards observed in 2014 followed by the efforts led by BCSA to facilitate duty holder management of those hazards.

The first section provides an overall summary of hazards and safety management efforts at an organizational level while the second section provides a similar analysis specific to each industry sector regulated by BCSA.

1 Certain municipalities administer portions of the Safety Standards Act in lieu of BCSA. These municipalities and their scope of administration are detailed in Appendix H.

Understanding Safety Risks in BC

INCIDENTS

Incidents involving work or equipment regulated by the *Safety Standards Act* are required to be reported to the appropriate provincial safety manager. BC Safety Authority (BCSA) investigates many of these incidents to gain an understanding of safety hazards in BC and what actions can be taken to manage those hazards. Figures 1 and 2 below show the total number of incidents reported to BCSA in 2014 and previous years.

FIGURE 1-1: INCIDENT REPORTS 2010-2014

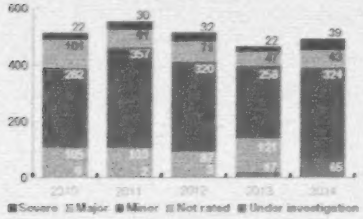
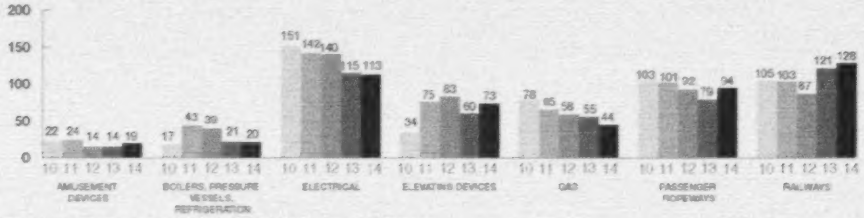


FIGURE 1-2: INCIDENT REPORTS BY REGULATED INDUSTRY SECTOR 2010-2014



Note 1: Incidents identified as UNDER INVESTIGATION were open at the time of report compilation.
Note 2: Prior to 2014, railway accidents and incidents are not given a rating and are identified as not rated in Figure 1-1.

TABLE 1-1: SEVERE AND MAJOR INCIDENTS IN 2014

SEVERE		MAJOR	
Qty	Type	Qty	Type
13	Railway rules and regulations not adhered to by operator of regulated equipment	18	Fires and/or explosions where regulated equipment was involved/ suspected to be involved
6	Public interaction with train activity	17	Railway rules and regulations not adhered to by operator of regulated equipment
5	Arcs or fires where regulated equipment was involved/suspected to be involved	7	Falls, trips, or other unintended contact with regulated or energized equipment
3	Falls, trips, or other unintended contact with regulated or energized equipment	7	Train derailment
3	Regulated equipment did not operate as expected/equipment failures	5	Carbon monoxide exposure
2	Dangerous goods or products released	5	Public interaction with train activity
2	Aerial deropements	2	Unsafe condition reported
2	Gas leaks	1	Aerial deropement
1	Carbon monoxide exposure	1	Dangerous goods or products released
1	Unsafe condition reported		
1	Regulated work performed by unlicensed contractor		

Overall, there were no significant changes in the number of incidents reported to BCSA or the distribution of their rating categorization. Fire-related incidents and unintended contact (including slips, trips and falls) with regulated or energized equipment were the predominant types of SEVERE and MAJOR incidents reported. The next most prominent type of incident resulted from poor adherence to railway rules and regulations which includes railways failing to properly secure railway equipment leading to uncontrolled movements. More information including basic descriptions of closed incidents occurring in 2014 is available in Appendix A1.

INJURIES

Injuries reported as a result of incidents are an important indicator of hazards inherent to the operation of regulated equipment. Injuries resulting from the incidents reported above are summarized below.

FIGURE 1-3: INJURIES REPORTED 2010-2014

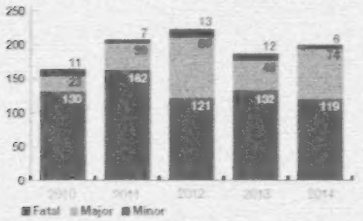
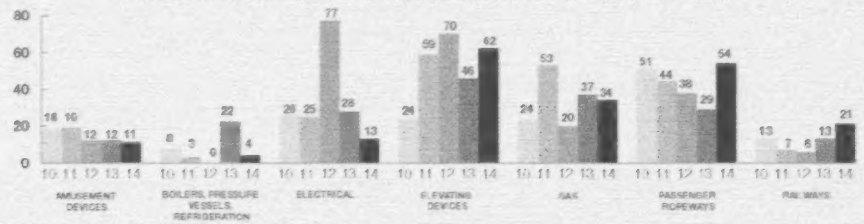


FIGURE 1-4: INJURY REPORTS BY REGULATED INDUSTRY SECTOR 2010-2014



Note 1: Injuries associated with incidents UNDER INVESTIGATION are excluded.
Note 2: BCSA receives its injury reports and descriptions from operators or first responders at the time of, or immediately following, the incident. Injuries may develop after the initial reports were made to BCSA and the long term effects of a resultant injury may not be recorded as part of BCSA's investigation.

TABLE 1-2: FATAL AND MAJOR INJURIES 2014

SEVERE		MAJOR	
Qty	Type	Qty	Type
6	From railway incidents	40	Possible head injury, bone fracture, soft tissues damage, and/or other unspecified injuries requiring hospital treatment
		30	Carbon monoxide exposure
		4	Ammonia exposure

The total number of injuries resulting from incidents was consistent with previous years. This year, BCSA decided to include occurrences of suicide related to railways which were excluded from statistics reported previously. All six railway incident investigations into an occurrence of death concluded that the death was likely intentionally self-inflicted. There were no fatalities in 2014 associated with electrical or gas equipment failures. The majority of MAJOR injuries resulted from unintended contact with regulated equipment and carbon monoxide exposure, which is consistent with previous reporting periods. One incident resulted in 15 residents of a building being sent for treatment relating to carbon monoxide exposure. More information about injuries resulting from completed incident investigations is available in Appendix A1.

SCOPE OF REGULATED WORK

BCSA oversees the safe installation and operation of technical systems and equipment. Our oversight model is largely based upon permits being issued for regulated work and equipment. BCSA also uses management plans and agreements with some organizations to facilitate oversight of regulated work and equipment. The volume of installation and operating permits and management plans issued or active provides an indication of the amount of regulated work being conducted within the safety system.

FIGURE 1-5 PERMITS 2010-2014

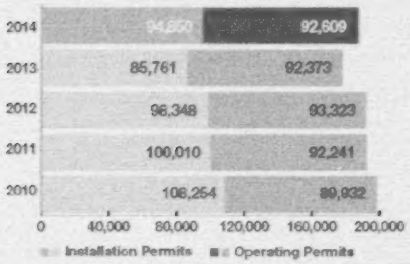


TABLE 1-3: PERMITS IN 2014

	NEW INSTALLATION PERMITS Note 1	OPERATING PERMITS Note 2
Amusement Devices	87	607
Boilers, PV, Refrigeration	796	52,944
Electrical	52,506	12,986
Elevating Devices	1,507	23,862
Gas	39,727	1,813
Passenger Ropeways	27	230
Railways	NA	130
Alternative Safety Approaches (ASA) [Note 3]	NA	37

Note 1: New installation permits include permits issued new in 2014 only. This number does not include permits that were issued in previous years and may have been assessed in 2014.

Note 2: Operating permits includes new permits issued in 2014 plus active permits that were issued in previous years.

Note 3: ASAs are not operating permits, but have some similar characteristics. In 2014, there were six Safety Management Plans and 31 Equivalent Standard Approaches.

ASSESSMENT OF REGULATED WORK

BCSA assesses regulated activities within the safety system to evaluate and enforce duty holder's obligations under the *Safety Standards Act* and regulations. BCSA issues licences and certificates of qualification to businesses and individuals who conduct 'hired' work under issued permits or on regulated equipment. Safety officers conduct physical assessments of permitted/regulated work and audits of management plans. These physical assessments and audits provide BCSA and its stakeholders with an understanding of strengths and weaknesses within the safety system and inform priorities for prevention, assessment and audit efforts.

In 2014, BCSA introduced a new system for reporting hazards found during assessments and audits of duty holders' work. This information is available for presentation from assessments/audits conducted after October 1, 2014. BCSA intends to include annual comparisons of these assessment volumes and outcomes in future years.

Compliance Assessments

FIGURE 1-6: COMPLIANCE OF DUTY HOLDERS' WORK - 2014

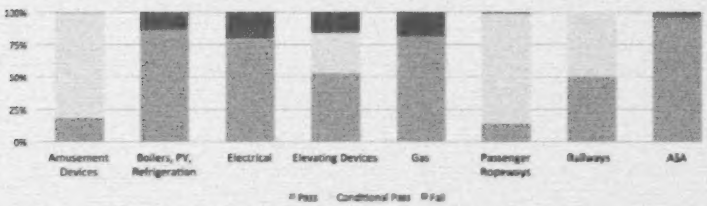


Figure 1-6 compares the compliance outcomes of physical assessments relative to the total physical assessments in each regulated industry sector. The values have been normalized as a percentage of the overall assessments to accommodate the vast differences between the assessment volumes in each industry sector. Compliance assessments result in a PASS, CONDITIONAL PASS or FAIL outcome and are defined in the Glossary of this report (Appendix J). The specific quantities of the assessments completed are presented in Table 1-4 below.

TABLE 1-4: COMPLIANCE OF DUTY HOLDERS' WORK 2014

PHYSICAL ASSESSMENT COMPLIANCE OUTCOME [NOTE 1]	AMUSEMENT DEVICES	BOILERS, PV, REFRIGERATION	ELECTRICAL	ELEVATING DEVICES	GAS	PASSENGER ROPEWAYS	RAILWAYS	ASA	TOTAL
Fail	2	388	4,280	399	1,395	2	0	1	**6,467**
Conditional Pass	358	0	87	766	2	153	61	0	**1,366**
Pass	81	2,504	16,358	1,313	6,070	25	63	24	**26,375**

Note 1: Physical assessments include all physical assessment activity performed by BCSA safety officers in 2014 for all new or active installation, new or active operating permits and inspections of unpermitted work.

Almost 20% of inspections conducted by BCSA safety officers conclude that the equipment or work does not comply with the *Safety Standards Act* or *Railway Safety Act*, and applicable regulations or technical codes and standards. Approximately 75% of inspections observe that equipment or work is suitably compliant.

Hazard Assessments

During each physical assessment of regulated work, safety officers will identify unintended and undesirable hazards. These are referred to as "as found" hazards as they reflect what the safety officers discovered when they initially observed the duty holders' work or equipment and not the condition following completion of the interaction with the safety officer. As found hazards are important as they provide an indication of how well duty holders independently understand and fulfill their safety obligations under the safety system. Hazard rating assignments range from INSIGNIFICANT to SEVERE and are collated in Figure 1-8 below. The first phase of the hazard assessment program was rolled out in 2014 and continuing adjustments will be made in 2015, including the calibration of ratings across technologies. Definitions of these ratings are provided in the hazard rating scale contained in Appendix J Glossary.

FIGURE 1-7 'AS FOUND' HAZARD ASSESSMENTS – OCTOBER TO DECEMBER 2014 [NOTE 1]

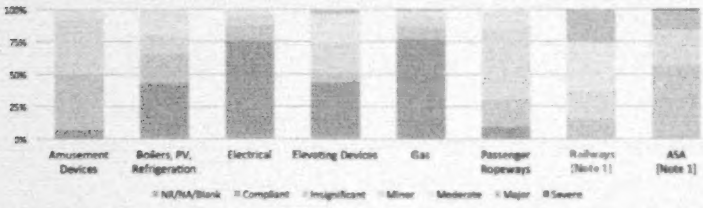


Figure 1-7 compares the distribution of hazard ratings observed by safety officers from October 1, 2014 to December 31, 2014 in each regulated industry sector. The values have been normalized as a percentage of the overall assessments to accommodate the vast differences between the assessment volumes in each industry sector. The quantities of the hazard ratings are outlined in Table 1-5 below. A summary of SEVERE and MAJOR hazards found between October 1, 2014 and December 31, 2014 is provided in Appendix B.

Note 1: Data in the Railways and ASA columns covers the period from January 1, 2014 to December 31, 2014. Other columns represent data recorded from October 1, 2014 to December 31, 2014.

TABLE 1-5: 'AS FOUND' HAZARD ASSESSMENTS – OCTOBER TO DECEMBER 2014 [NOTE 1]

	AMUSEMENT DEVICES	BOILERS, PV, REFRIGERATION	ELECTRICAL	ELEVATING DEVICES	GAS	PASSENGER ROPEWAYS	RAILWAYS [NOTE 1]	ASA [NOTE 1]	TOTAL
Severe	0	0	0	0	6	0	0	1	7
Major	0	2	9	18	17	0	25	15	86
Moderate	1	107	220	137	88	12	36	0	601
Minor	6	75	481	138	152	46	21	27	946
Insignificant	6	122	690	49	188	17	16	57	1,145
Compliant	1	217	4,230	251	1,491	8	0	0	6,198
No rating/ Not applicable	0	14	189	17	10	0	0	0	230

Note 1: Data in the Railways and ASA columns covers the period from January 1, 2014 to December 31, 2014. Other columns represent data recorded from October 1, 2014 to December 31, 2014.

Approximately seven percent (7%) of inspections between October 1 and December 31, 2014 identified a hazard that was rated by the safety officer as being MODERATE to SEVERE. Discussions relating to the content of these identified hazards can be found in each separate technology section as well as Appendix B.

MANAGEMENT DISCUSSION

At BCSA, we view incidents as linked to hazards and unsafe behaviour. In other words, incidents do not just occur, they happen because of hazards created by human and organizational behaviour. This "iceberg model" is simple and effective, both for understanding and managing safety risks.

FIGURE 1-8: ICEBERG MODEL

As a result of the combined effort of numerous involved parties, the number of incidents in British Columbia attributed to the use of technology regulated under the *Safety Standards Act* and *Railway Safety Act* is low. For example, there were zero fatalities reported in the electrical and gas technologies in 2014. This is good news, and the challenge is to continue to maintain or improve these high levels of safety. BCSA's record of created hazards observed by safety officers reflect the continued existence of unsafe situations, and flag the potential for serious incidents to occur.

Incident and hazard data reflects the persistence of the risks associated with carbon monoxide and ammonia exposure. This report includes multi-year incident studies into the 110 reported injuries and 9 fatalities that occurred between 2007and 2013, as well as into the 24 exposures to ammonia in the same period. In 2014, BCSA released investigation reports into two significant incidents in passenger ropeways. This report includes an incident study into 63 reported deropements that occurred with passenger ropeways (ski lifts) in the 2009 to mid 2014 period. Injuries that are self-inflicted, such as the six railway fatalities reported in 2014, form a special group of incidents within the technologies and incidents that we oversee.

In 2014, BCSA focused efforts on rolling out a program to observe and record hazards associated with regulated equipment and work. The goal is to build knowledge about the precursors to incidents, so that resulting injuries and damage can be prevented. In coming years, we intend to expand our data collection and share new safety insights with our clients and the public.

Managing Safety Risks in BC

STAKEHOLDER ENGAGEMENT PROGRAM

As a responsible regulator, BCSA recognizes the need for it to understand and respond to the legitimate needs of those interested in and affected by regulation. We understand that this means providing meaningful opportunities for stakeholders to contribute to the process of reviewing and revising regulatory policies. BCSA's stakeholder engagement process includes regular interaction with stakeholders at various levels and in various formats as outlined in this report.

While technical and regulatory issues have been the focus of most stakeholder consultation committees in previous years, BCSA further recognized in 2014 that stakeholder engagement on business-related issues is also vital to the alignment of policies, procedures and direction with clients' needs. Stakeholder engagement recognized the need to diversify its approach to obtaining feedback on issues and to this end, in 2014 BCSA:

- continued discussions on topical strategic issues with the Advisory Panel of Stakeholders;
- formalized a group of stakeholders as the IT Advisory Panel to give input on the direction of BCSA's information systems;
- initiated two Technology Advisory Committee sub-committees to deal with inter-technology issues and committee governance;
- and established an internal committee on certification and licensing.

By the end of 2014, there was a very slight increase in stakeholder engagement activities compared to 2013. There was an increase in the number of standing committees, balancing out the relatively low number of issue-specific consultations.

One issue-specific consultation was completed in 2014 that focused on the sustainability of the safety system. Fees for the electrical, elevating devices, gas and boilers, pressure vessels and refrigeration programs in 2015 through 2017 were established through industry consultation, culminating in a 3% annual increase to help sustain risk mitigation activities, and changes to align safety risks to services provided by BCSA.

Details of safety issues addressed through stakeholder engagement processes are provided in Appendix E.

TABLE 1-6: STAKEHOLDER ENGAGEMENT ACTIVITIES

NUMBER OF MEETINGS BY:	Qty.
BCSA Standing Committees	
Safety Standards Administrators' Group	6
Technology Advisory Committees	17
Advisory Panel of Stakeholders	2
IT Advisory Panel	2
Railway annual regional meetings	4
National Public Safety Advisory Committee	2
Internal committees	
Certification and licensing	2
NUMBER OF ACTIVE WORKING GROUPS, SUB-COMMITTEES AND STANDARDS COMMITTEES (EXCLUDING STANDING COMMITTEES LISTED ABOVE)	
Safety Standards Administrators' Group	0
Technology Advisory Committees	15
Number of active associations and National Codes and Standards Committees	43
NUMBER OF ISSUE-SPECIFIC CONSULTATIONS INITIATED	**1**

CLIENT EDUCATION

BCSA shares knowledge of hazards, best practices, industry regulation and standard changes with industry stakeholders through client education activities. These include presentations, discussions and conferences, and digital avenues in online forums and webinars. The following table summarizes client education activities and results in 2014.

TABLE 1-7: CLIENT EDUCATION PROGRAM ACTIVITIES [SEE NOTE 1 BELOW]

	ELECTRICAL	GAS	BOILER, PV, REFRIGERATION	RAILWAY	MULTI TECHNOLOGY (ANY COMBO OF EL, GA, BP, ED	TOTAL
Direct Reach	1161	500	61	4	42	**1768**
Activities (Conferences, Forums, Tech Talks, Panels, tradeshows)	34	19	6	1	2	**62**
New Development	3	2				**5**
Media						
Collaborations		1				**1**

Note 1: Definitions and descriptions for education terms are available in Appendix F.

In 2014, BCSA's "Education Program" was restructured into a "Client Education Program", focusing on external clients and becoming one part of a larger internal group concerned with education overall. Together with the technical and systems training programs, and with Occupational Health and Safety, an education committee now meets regularly to promote alignment and cohesion on common issues and opportunities.

In 2014, the Client Education Team delivered numerous Tech Talks, developed new client education activities such as breakfasts and conferences, and offered online events. Highlights include:

- Developed a comprehensive Client Education vision and strategy for 2014, and for 2015-16. This included direction on the changing nature of client education, new methods for delivering education, and a focus on digital solutions.
- Contributed to the development of the propane decal program for the "Be in the Know about CO" Carbon Monoxide safety program, in collaboration with the Canadian Propane Association.
- Piloted new outreach initiatives including Open Houses/Client Appreciation Days, Breakfast & Learn Events and Face-to-Face Forums.
- Researched, tested and delivered online forums in four technologies.
- Project Managed the implementation and testing of a Learning Management System and trained internal staff in online course development.
- Planned, coordinated and delivered two half-day conference events.

MEDIA RELATIONS AND COMMUNICATIONS

BCSA handles media requests and issues with proactive media releases to: warn of specific hazards; advise the public of steps they can take to reduce their risk of injury; and, provide comment and context to safety issues that are of interest to the media. From January 1 to December 31, 2014, BCSA responded to media inquiries and conducted media relations relating to each industry sector.

TABLE 1-8: MEDIA RELATIONS SUMMARY

	AMUSEMENT DEVICES	BOILER, PV, REFRIGERATION	ELECTRICAL	ELEVATING DEVICES	GAS	PASSENGER ROPEWAYS	RAILWAYS	ASA	TOTAL
Media releases/statements issued or interviews conducted in 2014 [Note 1]	7	7	24	12	28	25	6	0	**110**
Reference: Media relations activity in 2013	7	8	20	7	17	6	6	0	**71**

Note 1: In several cases, a media relations action may relate to two or more technologies. For example, a media release about enforcement actions would relate to all technologies, excluding Railways. Details of each media release are provided in Appendix G.

LICENSING AND CERTIFICATION

BCSA issues licences to businesses that perform regulated work. BCSA also issues certificates of qualification to individuals that demonstrate a required level of knowledge and experience. Licensing and certification assures that minimum standards of knowledge and capability are maintained for the completion of regulated work.

TABLE 1-9: NEW LICENCES AND CERTIFICATES OF QUALIFICATION ISSUED

ACTIVITIES	AMUSEMENT DEVICES	BOILER, PV, REFRIGERATION	ELECTRICAL	ELEVATING DEVICES	GAS	PASSENGER ROPEWAYS	RAILWAYS	ASA	TOTAL	REFERENCE 2013 TOTAL
New Licences	24	71	309	1	284	3			692	715
New Certificates of Qualification	0	872	555	148	810	2	Note 1	Note 2	2,387	2,432

Note 1: The Railway Safety Act does not define the use of Licences or Certificates of Qualification.

Note 2: The Alternative Safety Approaches Regulation does not define the use of Licenses or Certificates of Qualification

Exam Results

In addition to obtaining the required experience, individuals must pass the relevant exam (or a series of exams) to obtain a certificate of qualification. These exams help to reinforce the importance of duty holders demonstrating they have appropriate safety knowledge before working in areas where their decisions have the potential to affect the safety of others. These requirements are detailed in the *Safety Standards Act* and regulations. In 2014, there were 3880 exams taken.

This year's State of Safety Report includes the distribution of exam marks relative to the pass/fail grade to inform discussions and planning around qualifications of workers subject to the *Safety Standards Act*.

TABLE 1-10: EXAMS TAKEN IN 2014

REGULATED INDUSTRY SECTOR	QTY EXAMS	PASS RATE (%)	DISTRIBUTION OF RESULTS
Boilers, Pressure Vessels and Refrigeration	2,060	77%	
Electrical	639	84%	
Elevating Device	378	94%	
Gas	803	88%	

In Table 1-10 above, the blue area represents the distribution of the quantity of exams written and marked in 2014 relative to the pass/fail grade (red line) by regulated industry sector. The range of the horizontal axis (x- axis) is from 0% to 100% and is divided equally in 5% increments. The pass/fail grade is either 70% (for electrical, gas and elevating device exams) or 65% (for power engineering, boilers, pressure vessels and refrigeration exams). Result distributions for each exam type are available in the individual industry sections. A noticeable shift around the pass/fail line can be observed as a result of allowances for errors in examination results.

ENFORCEMENT

BCSA compels compliance with the *Safety Standards Act* where safety hazards are found, or individuals have resisted attempts to make their work or equipment compliant or have chosen to operate outside the safety system. Safety officers work with industry to establish compliance and address unsafe conditions. In some cases, as-found conditions result in the safety officer determining that the physical assessment has resulted in a "failed" condition, which requires the duty holder to correct certain non-compliances before proceeding with additional work. In some cases, a safety order may be issued to address safety hazards. However, where those efforts do not achieve results, BCSA may issue a compliance order or warning notice and, eventually, a sanction (such as a monetary penalty or discipline order) in accordance with the *Safety Standards Act*. A listing of all enforcement actions taken by BCSA is included in Appendix C.

TABLE 1-11: COMPLIANCE AND ENFORCEMENT ACTIVITY [NOTE 1]

ACTIVITIES	AMUSEMENT DEVICES	BOILER, PV, REFRIGERATION	ELECTRICAL	ELEVATING DEVICES	GAS	PASSENGER ROPEWAYS	RAILWAYS	ASA	TOTAL	REFERENCE 2013 TOTAL
Failed physical assessments [Note 2]	2	388	4,280	399	1,395	2	0	1	8,467	NA
Safety Orders [Note 3]	0	0	0	2	0	0	0	0	2	3
Warning Notices	0	0	50	0	53	0	0	0	103	36
Compliance Orders	1	2	31	2	24	2	Note 4	0	60	53
Sanctions	0	0	5	2	2	0	Note 4	0	9	16

Note 1: Failed physical assessments, safety orders and warning notices are compliance actions. Compliance orders and sanctions are enforcement actions.

Note 2: Physical assessments where the safety officer has assessed that the regulated work was found NOT sufficiently compliant with the Safety Standards Act, regulations and/or applicable technical code(s) and require the duty holder to correct non-compliances.

*Note 3: Safety orders may require one or several duty holders to address and resolve safety hazards. Details on safety orders issued are included in Appendix D or online at **www.safetyauthority.ca**.*

Note 4: Listed categories of enforcement actions are not defined in the Railway Safety Act.

TABLE 1-12: ENFORCEMENT ACTIONS BY CATEGORY

ACTION	CATEGORY	Qty
Compliance Order	No contractor license	31
	Expired contractor license	7
	No permit	5
	Use of unqualified workers	4
	Outstanding non-compliances	4
	Tampering or unsafe use of regulated equipment	3
	Sale of uncertified equipment	2
	Provide records	2
	Failure to request inspection	1
	Failure to report an incident	1
Sanction	Monetary Penalty – Failure to Comply with a compliance order	6
	Discipline order – failure to comply with a safety order or compliance order	1
	Monetary Penalty – Performing regulated work without the required permission	1
	Monetary Penalty – Failure to comply with a safety order	1

REGULATORY INSTRUMENTS AND AMENDMENTS

BCSA uses certain regulatory instruments to assist with the administration of the *Safety Standards Act* and the *Railway Safety Act*. Safety orders are issued to prevent or reduce the risk of personal injury or damage to property. Directives are instruments that clarify or provide new interpretation of a regulation or code. Compliance with safety orders and directives is mandatory and enforceable by BCSA. Information bulletins provide helpful information and clarification on existing regulations or codes. BCSA also works with the Government of British Columbia to amend acts and regulations. Amendments have been initiated by BCSA through a recommendation for amendment submission to the provincial government. A listing of all regulatory instruments issued and recommendations and amendments made by BCSA is included in Appendix D.

TABLE 1-13: REGULATORY INSTRUMENTS AND AMENDMENTS

ACTIVITIES	AMUSEMENT DEVICES	BOILER, PV, REFRIGERATION	ELECTRICAL	ELEVATING DEVICES	GAS	PASSENGER ROPEWAYS	RAILWAYS	ASA	TOTAL	REFERENCE 2013 TOTAL
Safety Orders	0	0	0	2	0	0	0	0	2	4
Directives	0	2	0	4	7	0	0	0	13	10
Bulletins	0	2	2	3	3	0	0	0	10	18
Recommendations for Amendment	0	1	0	0	0	0	0	0	1	1
Amendments	0	1	0	1	0	0	0	0	2	2

Safety Order – Combustible Wood Dust

As a result of the investigations into Babine Forest Products and Lakeland Mills sawmill explosions in 2012, BCSA learned that wood processing facilities may have equipment installed in locations deemed hazardous because of the potential presence of combustible dust. Unacceptable levels of combustible wood dust present a potential combustion hazard when the regulated equipment is not suitable for use in such a potentially hazardous location. In 2013, in response to the recommendations from the incident investigations, BCSA issued a safety order to the industry requiring operators of wood processing facilities to:

- Use qualified persons to assess their mill and operation to identify any hazardous locations that contain regulated equipment;
- Determine if the regulated equipment is suitable for use in that hazardous location;
- Implement a dust management plan to either modify the equipment or manage the dust environment; and
- Implement a management of change process to maintain a safe environment for regulated equipment.

At the time the safety order was issued, 227 wood processing facilities were required to respond to the safety order, and all of those facilities did respond. After receiving the required response, BCSA conducted an assessment of that facility to evaluate the effectiveness of the operator in identifying hazardous locations and managing any dust hazards. Due to the opening of new facilities, or the closing of existing facilities, BCSA has conducted assessments of 237 facilities.

As a basis for evaluating the condition of a facility, BCSA used criteria within standards issued by the National Fire Protection Association: NFPA 499—Recommended Practice for the Classification of Combustible Dusts and of Hazardous (Classified) Locations for Electrical Installations in Chemical Process Areas; and NFPA 664—Standard for the Prevention of Fires and Explosions in Wood Processing and Woodworking Facilities.

The initial assessments of compliance conducted by BCSA focussed on five main areas:

- Was a hazardous area classification performed and documented by the operator?
- Did the operator use an appropriate standard for the classification?
- Was the classification performed by a person qualified to use that standard?
- Was a dust mitigation plan documented by the operator?
- Did facility conditions match expectation?

FIGURE 1-9: INITIAL WOOD DUST ASSESSMENT FINDINGS

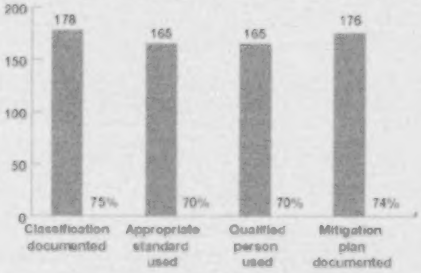
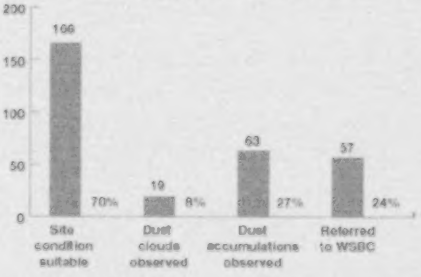
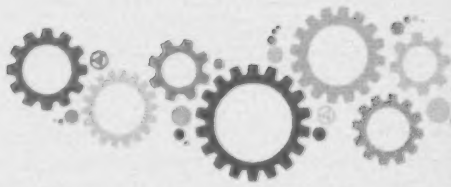


FIGURE 1-10: INITIAL SITE CONDITION FINDINGS





From the initial findings, 70% of operators correctly complied with the requirements of the safety order to conduct a hazardous area classification using a recognized standard and performed by qualified persons, and to document that classification. The three main areas of non-compliance were:

- Failure to use an appropriate standard for the area classification
- Failure to use a qualified person to perform the classification
- Failure to appropriately document the classification.

BCSA also conducted inspections of the facilities at the time of the initial assessment. In 70% of facilities either dust levels within 30 feet of the equipment were adequately managed or the equipment was suitable for a dust environment. Notably, 18 facilities had a suitable dust mitigation plan, but were not managing the facility based on that plan, and 19 facilities did not have a suitable area classification, yet were managing the facility to control the dust hazard. Additionally, 57 facilities were referred to WorkSafeBC (WSBC) because of concerns about accumulations of wood dust or the presence of wood dust clouds outside areas containing regulated equipment.

TABLE 1-14: BCSA COMBUSTIBLE WOOD DUST ASSESSMENTS

	Total BCSA Assessments	**237**	
BCSA ASSESSMENT OF OPERATOR OBLIGATIONS	Number of facility operators who completed and documented an assessment of their facility to identify any hazardous locations that contain regulated equipment	178	75%
	Number of facility assessments performed by qualified persons using recognized standards to evaluate the condition of any locations that contain regulated equipment	165	70%
	Number of facilities that identified hazardous locations containing regulated equipment and developed a dust mitigation strategy	176	74%
	Number of facility operators that inspected their own facility to determine the effectiveness of their dust mitigation strategy	165	70%
BCSA ASSESSMENT OF SITE CONDITION	Number of facilities with acceptable dust management plans for locations containing regulated equipment	166	70%
	Number of facilities with observed dust clouds in locations containing regulated equipment	19	8%
	Number of facilities with observed accumulations of wood dust in locations containing regulated equipment	63	27%

BCSA has prioritized 138 mills for follow-up inspections in 2015 for on-going compliance to the intent of the safety order. Prioritization is based upon the outcomes of initial inspections:

- Quality of the site's hazardous location assessment and use of qualified persons and industry standards,
- Condition of the site relative to the presence of dust and the mill's assessment and management plan, and
- General degree of cooperation from site.

As a result of its investigations, BCSA has influenced significant changes to the combustible dust sections of the Canadian Electrical Code. These changes will be introduced in 2015 and BCSA will be conducting various awareness sessions with stakeholders so that the hazards presented by combustible dust and the responsibilities for electrical code compliance within wood processing facilities are better understood.

CODE AND STANDARD DEVELOPMENT

BCSA employees participate with and lead the development of many technical code and standard committees. Participation in these processes brings BCSA's focus on risk to the discussion and assures that challenges facing BC industries are presented and considered. A listing of all industry associations and national codes and standards committees in which BCSA participated for 2014 is included in Appendix E.

MANAGEMENT DISCUSSION

The activities of assessment, education and outreach, research, and enforcement form the Accident Prevention Model and provide for effective and efficient safety oversight. We will continue to improve the management of safety risks by including learning captured through incident investigation, high hazards identified during assessments and unpermitted work. One of the tools BCSA uses to align its efforts to concerns within the safety system is the 'Technical Risk Register'. This register is included in Appendix I.

An equitable safety system is one in which all participants are meeting their responsibilities as duty holders and are compliant with regulations. A gap in duty holders' understanding of their obligations and responsibilities to the safe installation and operation of regulated technical equipment remains an area of focus. To address this opportunity, stakeholder working groups were formed in the Electrical, Gas and Passenger Ropeway technologies to review existing, and enhance/develop certification programs. The work will continue into next year along with supporting our clients with education initiatives such as Tech Talks and conferences.

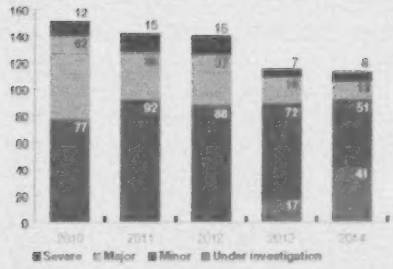
Another area of focus in 2014 was the continuation of the implementation of the combustible dust safety order. All identified wood processing facilities responded to the safety order and BCSA conducted an assessment of those facilities to evaluate the effectiveness of the operator in identifying hazardous locations and managing dust hazards. Based on those findings, follow up inspections in 2015 will be performed to determine ongoing compliance with the safety order.

Finally, BCSA reached out in 2014 to involve the next generation of safety system participants. We hired a 4th year summer engineering student who worked on various areas of safety system development, including duty holder communications and innovations in the use of information technology and assessment resources. BCSA also engaged the first-year University of Victoria engineering class to explore possible design solutions for deropements in passenger ropeways. This work with university students helped to shape our communications with industry and exposed the next generation of technical system leaders to some of the practical challenges faced by our safety system.

Understanding Electrical Safety Risks

In the Electrical Safety Program at BC Safety Authority (BCSA), we are responsible for overseeing the safety of electrical systems across British Columbia in accordance with the *Safety Standards Act* and the Electrical Safety Regulation. Municipalities that have separate administrative agreements with the Province are identified in Appendix H.

FIGURE 2-1:
ELECTRICAL INCIDENT REPORTS 2010-2014



INCIDENTS

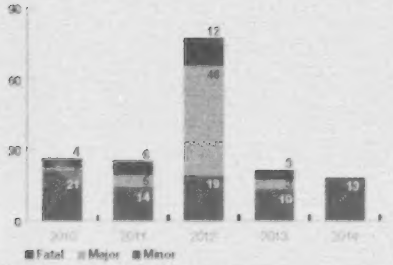
The following summarizes incidents reported to BCSA involving electrical (EL) equipment.

TABLE 2-1: ELECTRICAL SEVERE AND MAJOR INCIDENTS IN 2014

Rating	Qty	Description
SEVERE	4	Arc flash
	2	Contact with energized equipment/object
	1	Equipment failure (phase-to-phase short)
	1	Unsafe condition reported (exposed and energized 240V wiring)
MAJOR	6	Residential fires where regulated equipment or work was involved or suspected to be involved
	6	Fires at commercial, industrial or agricultural sites where regulated equipment or work was involved or suspected to be involved
	1	Unsafe condition reported

There were no significant changes to the volume or distribution of electrical incidents reported to BCSA in 2014 as compared to previous years. Arc flash and contact with energized equipment incidents were generally associated with workers not following established safe practices around electrical energy or workers not understanding the electrical equipment they were working around. Fires associated with electrical equipment were generally attributed to product failures and unsafe installation practices. Other incidents included arc flashes and unintended contact with energized electrical equipment. A summary of closed incident investigations is included in Appendix A1.

FIGURE 2-2: ELECTRICAL INJURIES REPORTED 2010-2014 [NOTE 1]



Note 1: BCSA receives its injury reports and descriptions from operators or first responders at the time of, or immediately following, the incident. Injuries may develop after the initial reports were made to BCSA and the long term effects of a resultant injury may not be recorded as part of BCSA's investigation.

INJURIES

Injuries reported as a result of electrical incidents are summarized below.

TABLE 2-2: MAJOR INJURIES REPORTED IN 2014

Rating	Qty	Description
MAJOR	0	

There were no FATAL or MAJOR injuries associated with closed investigations in 2014 which is a reduction from previous years. It is noted that several incidents remain 'under investigation' at the time of compiling this report and as such, their associated injuries are not included. MINOR injuries consisted of smoke inhalation from fires, electrical shocks from contact with energized parts and burns from arc flashes.

ASSESSMENTS OF REGULATED WORK

Electrical safety officers assess new installations as well as operating equipment as part of BCSA's administration of the *Safety Standards Act*. These physical assessments provide BCSA and its stakeholders with an understanding of strengths and weaknesses within the safety system and inform priorities for prevention, assessment and audit efforts. During each physical assessment of regulated work, safety officers identify whether the work complies with the act, regulations and technical codes as well as identify hazards. These 'as found' hazards reflect what the safety officers discovered when they initially observed the duty holders' work or equipment, and not the condition following completion of the interaction with the safety officer. A summary of SEVERE and MAJOR hazards found between October 1, 2014 and December 31, 2014 is provided in Appendix B, along with the hazard rating scale.

FIGURE 2-3:
EL PERMITS 2010-2014

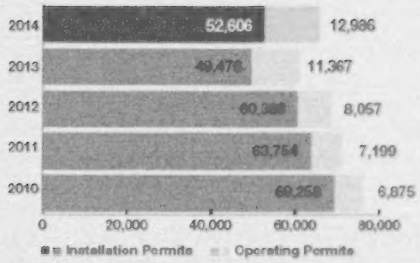


FIGURE 2-4:
EL PHYSICAL ASSESSMENT RESULTS IN 2014

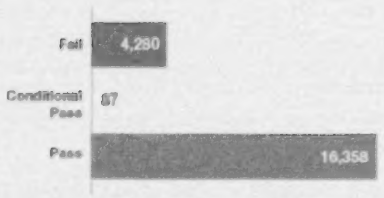
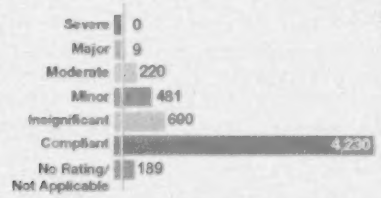


FIGURE 2-5:
HAZARDS RECORDED IN Q4-2014



Each inspection request is assessed by safety officers, and prioritized according to various factors. Risk is one of the primary considerations for prioritizing physical assessments. The Resource Allocation Program (RAP) employs both analytics and professional judgment to assess risks and to improve our understanding of risk. A score (called a RAP score) is generated through an algorithm that utilises historical data such as past history of compliance, scope of electrical work, and type of physical assessment. The RAP score provides safety officers with a preliminary risk assessment for each inspection request and a consistent, quantifiable result that can be used to prioritize the need for physical assessments.

Fifty-nine percent of the permits issued were for residential single dwellings, and 29% of the permits issued were for electrical work at commercial or industrial facilities. Homeowner permits made up approximately 2% of all electrical installation permits issued in 2014.

Safety officers carried out 20,725 physical assessments in 2014. Of those physical assessments, 79% were found to be fully compliant, and 21% were cited as non-compliant. Safety officers identified 220 moderate and nine high risk hazards during their physical assessments.

Managing Electrical Safety Risks

STAKEHOLDER ENGAGEMENT

In order to help invest in safety services that fit the needs of larger projects and specific clients, BCSA consulted on eliminating the cap on two electrical fees: maximums on installation permit fees for higher value jobs, and maximums on accounts for municipalities, school districts and health authorities. In 2014, there was a growing number of large industrial installation projects, which typically require greater levels of oversight, and a further shift away from a time when regulation of electrical work was overseen by the provincial government. Following consultation, 2015 electrical fees will see the installation permit fee cap removed, and a phased approach to eliminating the account cap.

The Electrical Technology Advisory Committee met four times in 2014, and established the need for two working groups to address the following technical safety and regulatory improvement issues:

- Review of BCSA's annual operating permits process.
- Review of the 2015 edition of the Canadian Electrical Code.

In addition, two working groups reporting to the Electrical Technology Advisory Committee concluded their work as follows:

- The Recognition of Electrical Training Programs Working Group submitted their final recommendation, which defined requirements for the provincial safety manager when reviewing applications for recognition of electrical training programs.
- The Electrical Safety Regulation Section 18 Working Group disbanded after they concluded that clarifying permit requirements for electrical work would be best handled by issuing a directive. The directive is currently under review by the Safety Standards Administrators' Group.

The electrical safety managers of the Safety Standards Administrators' Group met three times in 2014 to discuss how to improve consistency among the authorities having jurisdiction over electrical safety in BC. In response to the Incident Reporting Working Group's final recommendations submitted in 2013, an online mechanism for all municipalities to report incidents within a common incident report was established. Improvements to this online tool are anticipated in 2015, with the aim to more readily analyze information across all authorities having jurisdiction over electrical safety, collectively identify issues and corrective actions.

CLIENT EDUCATION EVENTS

BCSA conducted 29 Electrical Tech Talks, two Breakfast & Learn events, two Client Appreciation events and two Technology Conferences in 2014, covering 13 topics and reaching 1188 stakeholders across BC. More details on each event can be found in Appendix F.

TABLE 2-3: ELECTRICAL EDUCATION EVENTS CONDUCTED IN 2014

TITLE / TOPIC	Qty of Participants
2012 Electrical Code Changes	14
Certification Requirements for Manufactured Homes and Recreational Vehicles	90
Generators	60
60 Things Every Electrician Should Know	473
WFMA Lunch & Learn (Operating Permits)	20
CAHPI BC Conference - Electrical Tech Talk	50
Barn Wiring	92
Introduction to BCSA	67
New Electrical Contractors Breakfast	25
MyConnection Breakfast	60
Northern Region BCSA office Open House	75
Lower Mainland North Region BCSA office Open House	45
Innovative and Sustainable Electrical Energy Conference	90
Total	**1,161**

MEDIA RELATIONS

BCSA managed 24 media relations actions in 2014 related to electrical safety. A listing of all media relations activities can be found in Appendix G.

LICENSING AND CERTIFICATION

BCSA requires that electrical equipment is installed, operated and maintained by qualified and knowledgeable professionals. In 2014, 309 new contractor licences and 555 certificates of qualification were issued.

TABLE 2-4: NEW ELECTRICAL LICENCES AND CERTIFICATES OF QUALIFICATION ISSUED

TYPE	DOCUMENT	Qty Issued in 2014	Qty Issued in 2013
Licence	Contractor Licence	309	348
Certificate of Qualification	Field Safety Representative, Class A	65	58
	Field Safety Representative, Class B	318	291
	Field Safety Representative, Class C	3	2
	Field Safety Representative, Full Entertainment	7	5
	Field Safety Representative, Low Energy Systems	31	24
	Field Safety Representative, Power Line Technician	1	1
	Field Safety Representative, Refrigeration Mechanic	89	185
	Field Safety Representative, Security Alarms Installer	27	13
	Field Safety Representative, Solar Photovoltaic Systems	0	1
	Field Safety Representative, Underground Raceway Installer	13	22
	FSR Water Well Installer	1	0

Exam Results

In addition to obtaining the required experience, individuals must pass the relevant exam (or a series of exams) to obtain a certificate of qualification. These exams help to reinforce the importance of duty holders demonstrating they have appropriate safety knowledge before working in areas where their decisions have the potential to affect the safety of others. These requirements are detailed in the *Safety Standards Act* and regulations. In 2014, there were 639 electrical exams taken.

This year's State of Safety Report includes the distribution of exam marks relative to the pass/fail grade to inform discussions and planning around qualifications of workers subject to the *Safety Standards Act*.

TABLE 2-5: ELECTRICAL EXAM RESULT DISTRIBUTION

EXAM	QTY EXAMS	PASS RATE (%)	DISTRIBUTION OF RESULTS
All electrical exams taken in 2014	639	84%	
FSR Class A	79	80%	
FSR Class B	368	83%	
FSR Full Entertainment	10	70%	
FSR Low Energy Systems	28	89%	
FSR Refrigeration Mechanic	102	83%	
FSR Security Alarms Installer	28	93%	
FSR Underground Raceway Installer	13	100%	
FSR Class C, FSR Power Line Technician, Local Electrical Safety Officer, Provincial Electrical Safety Officer	11 [Note 1]	100%	

*Note 1: BCSA is subject to the **Freedom of Information and Protection of Privacy Act**. Provincial legislation restricts the information that may be published where individuals may be identified; accordingly, where there are nine or fewer exams written in an exam type, the results and distribution are combined with other exam types.*

In table 2-4 above, the blue area represents the distribution of the quantity of exams written and marked in 2014 relative to the pass/fail grade (red line). The range of the horizontal axis (x-axis) is from 0% to 100% and is divided equally in 5% increments. The pass/fail grade is 70% for electrical exams. A noticeable shift around the pass/fail line can be observed as a result of allowances for errors in examination results.

ENFORCEMENT ACTIONS

The following table summarizes the enforcement actions taken in the electrical sector in 2014. A listing of all compliance orders and sanctions is included in Appendix C.

TABLE 2-6 ELECTRICAL ENFORCEMENT ACTIONS

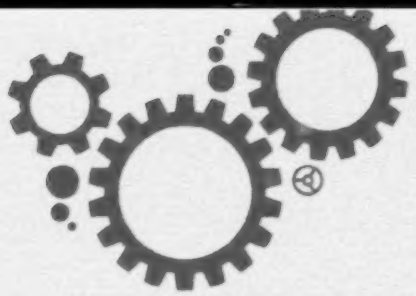
	WARNING NOTICES	COMPLIANCE ORDERS	SANCTIONS
Expired contractor license	0	3	0
Failure to comply with a compliance order	0	0	5
Failure to report an incident	0	1	0
Failure to request inspection	0	1	0
No contractor license	0	14	0
No Permit	33	3	0
Outstanding non-compliance(s)	0	2	0
Provide records	0	1	0
Tampering or unsafe use of regulated equipment	0	2	0
Unauthorized person performing regulated work	12	0	0
Use of unqualified workers	0	3	0
Use or disposal of uncertified products	5	1	0

REGULATORY INSTRUMENTS AND AMENDMENTS

BCSA issues safety orders, directives and information bulletins to stop unsafe activity and provide clarification of regulatory requirements and interpretations. Additional details can be found in Appendix D or at www.safetyauthority.ca.

TABLE 2-7: ELECTRICAL REGULATORY INSTRUMENTS

TYPE	DOC. NO.	TITLE / DESCRIPTION
Bulletin	B-E3 071019 3 Revision 5	Approved Certification Marks for Electrical Products
Bulletin	IB-EL-2014-01	Load Calculations for Row Housing – Rule 8-200 (2)



SAFETY MANAGER'S DISCUSSION

BC Safety Authority continued to focus its attention on areas of higher risk in 2014. BCSA safety officers performed physical assessments for 92% of requests that were deemed to be high priority as established by our risk-informed Resource Allocation Program. Safety officers also investigated 200 sites with potential electrical hazards, and work suspected of having been performed without permits.

A number of incidents at recreational vehicle parks in British Columbia have raised concerns that out-dated design at these facilities may no longer be adequate for modern recreational vehicles. Older recreational vehicle parks were originally designed to accommodate units that were rated maximum 30 A. Many newer recreational vehicles now have up to 50 A ratings. There are indications that electrical systems at recreational vehicle parks are being overloaded. This item has been added to the watch list on the Electrical Technology Risk Register, and BCSA will be attempting to collect more information through 2015. Electrical contractors and recreational vehicle park owners are encouraged to report any electrical incidents or unsafe electrical hazards to BCSA to assist in identifying potential safety risks.

BCSA implemented the use of Electrical Hazard Maps in 2014, as a tool for improving our understanding of safety related to electrical work. The Electrical Hazard Map consists of a scoring matrix that identifies the basic hazards being addressed by the BC Electrical Code (see Object and Appendix K in the BC Electrical Code), and key factors that influence the severity of the respective basic hazards. Upon identifying non-compliances, safety officers use the hazard map to identify the basic hazard and key factors that influence the severity of the hazard to apply a rating.

The field safety representative (FSR) is a cornerstone for the Electrical Safety Program. The certification of FSRs is intended to ensure that contractors and owners have access to specialized technical knowledge. FSRs are responsible for ensuring that all electrical equipment and work is compliant with electrical safety standards, and that electrical work is only performed or supervised by individuals who are qualified. Assessment of the FSR Certification Program has raised concerns that current practices are not adequate. Improvements to the program will be required in order to better equip these individuals to carry out their duties, and to provide improved processes for monitoring FSR performance. Enhancements to the program will require improvement to training, examination and certification, performance monitoring, and enforcement.

In 2010, the electrical safety manager identified "potential unsafe practices by FSR due to their lack of up-to-date knowledge of codes and standards" as a safety risk in the Electrical Technology Risk Register. The concern identified in the Risk Register was that field safety representatives without up-to-date knowledge of codes and standards may cause some installations to be at risk and that FSR effectiveness was consequently diminished.

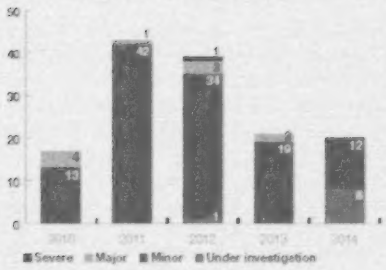
Examination of the FSR Registry has determined that more than two thirds of individuals who are currently registered as FSRs have not submitted an inspection request within a five year period. Contact information for many individuals is not current, and some individuals may no longer be residing or working in British Columbia. Therefore, one of the first enhancements to Field Safety Representative Certification will be a requirement to renew certificates on a regular basis in order to keep information current and accurate. Discussions with industry stakeholders on further enhancements to the program will continue through 2015.

Ulrich Janisch
Electrical Safety Manager

Understanding Boilers, Pressure Vessels and Refrigeration Safety Risks

In the Boilers, Pressure Vessels and Refrigeration (BPVR) Safety Program at BC Safety Authority (BCSA), we are responsible for overseeing the design, construction, installation and operation of boilers, pressure vessels and refrigeration plants throughout British Columbia in accordance with the *Safety Standards Act* and the Power Engineers, Boiler, Pressure Vessel and Refrigeration Safety Regulation.

FIGURE 3-1:
BPVR INCIDENT REPORTS 2010-2014

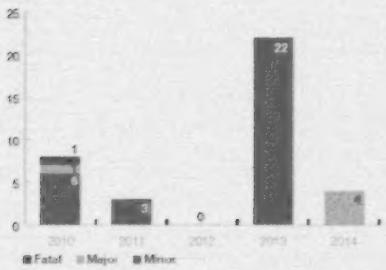


INCIDENTS

The following summarizes incidents reported to BCSA involving BPVR equipment.

In 2014, seven of the twelve MINOR incidents reported were related to ammonia refrigerant releases resulting primarily from system component failures and operator errors. There were several incidents open at the time of report preparation. A summary of closed incidents is included in Appendix A1.

FIGURE 3-2: INJURIES REPORTED 2010-2014 [NOTE 1]



Note 1: BCSA receives its injury reports and descriptions from operators or first responders at the time of, or immediately following, the incident. Injuries may develop after the initial reports were made to BCSA and the long term effects of a resultant injury may not be recorded as part of BCSA's investigation.

INJURIES

Injuries reported as a result of BPVR incidents are summarized below.

TABLE 3-1: MAJOR INJURIES REPORTED IN 2014 [NOTE 1]

Rating	Qty	Description
MAJOR	4	Ammonia exposure

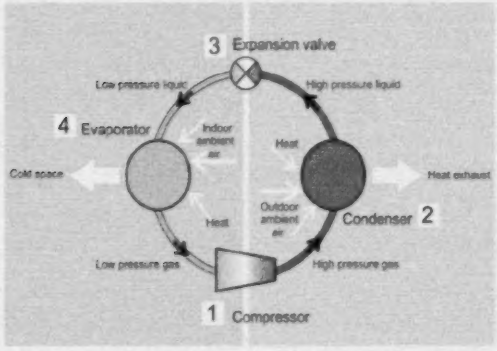
Two of the incidents reported in 2014 resulted in four people being exposed to ammonia. The release of ammonia has been observed to be a risk to the people who may be exposed to the chemical as well as the property due to ammonia contamination. This year's annual State of Safety Report includes a summary of the previous seven years of incidents involving the release of ammonia and reported injuries.

AMMONIA RELEASE INCIDENTS (2007 TO 2013)

Refrigeration Basics

A refrigeration system is comprised of interconnected parts forming a closed system in which refrigerant is circulated for the purpose of extracting and exhausting heat energy. The expansion of a gas in a closed system results with a release of heat energy and a decrease in the temperature of the gas. Conversely, the compression of a gas in a closed system results with an absorption of heat energy and an increase in the temperature of the gas. A refrigeration system uses this absorption and release of heat energy through the refrigerant to transfer heat from one location and exhaust it to another location. Figure 3.1-1 below and the accompanying cycle description illustrate this basic refrigeration cycle.

FIGURE 3.1-1: BASIC REFRIGERATION CYCLE



1. *The refrigerant enters the compressor as a low-pressure gas and is compressed into a high-pressure gas, heating the refrigerant.*
2. *The heated high-pressure refrigerant gas enters the condenser, removing heat and condensing the refrigerant to a high-pressure liquid.*
3. *Rapid expansion of the liquid refrigerant through the expansion valve rapidly cools the refrigerant resulting with a low-pressure liquid/gas mixture.*
4. *Heat from the ambient air is absorbed by the cooled refrigerant, resulting with a low-pressure gas and cooling the refrigerated space. The cycle repeats.*

Typical Refrigerants

System components and refrigerants are determined by occupancy, system performance requirements and refrigerant classifications. There are several refrigerants that can be used in refrigeration systems: the refrigeration system designer would select the refrigerant based on compatibility (i.e., materials used in construction and installation must be suitable for conveying the refrigerant), cost, efficiency, and environmental effects. Table 3.1-1 identifies some typical refrigerants and their properties.

Since the 1930s, chlorofluorocarbon (CFC)-based refrigerants were commonly used for their inert characteristics and low boiling points. The consumption and manufacture of CFCs has declined since the 1970s due to their environmental effects and has led to manufacturing and evaluating alternative refrigerants.

Ammonia (anhydrous ammonia or NH_3) emerged as an alternative to CFC-based and hydrofluorocarbon (HFC)-based refrigerants. Ammonia occurs naturally in the environment in low concentrations as a by-product of microbial processes and from the decomposition of organic matter. It is also manufactured for a variety of uses in the agricultural, chemical, manufacturing and refrigeration industries. It is used in industrial heat extraction, in sport and leisure facilities, and in the food production industry for processing, preservation, cold storage and commercial retail systems.

Ammonia has a distinctive odour that is detectable at low concentrations. Even in low concentrations, ammonia can be irritating to the eyes, skin and breathing passages. Table 3.1-1 compares the properties and possible effects of ammonia and other refrigerants.

Refrigerant Hazards

While the refrigerant is contained in the system, it presents no hazard to people or the environment. A hazard may be presented when there is an uncontrolled, unexpected release of refrigerant from the system. These containment failures, or refrigerant leaks, usually result from one of the following two conditions:

- The refrigerant pressure has increased above the normal operating pressure of the container, component or system, or
- A component, the piping and/or system was compromised such that it will no longer hold the operating refrigerant pressure.

Potential health hazards to persons exposed to refrigerant leaks and environmental hazards are identified in table 3.1-1. Health hazards can range from mild and temporary discomfort to irreversible serious damage to exposed tissues, depending

upon the type of exposure. Injuries in BC have been reported as a result of ammonia releases and subsequent exposure to maintenance personnel or other persons in the vicinity of the leak. As a result, this report primarily focuses on summarizing ammonia usage and incidents in BC within the context of other refrigerants and pressure vessels.

TABLE 3.1-1: REFRIGERANT PROPERTIES AND POTENTIAL EFFECTS

REFRIGERANT	Anhydrous ammonia [1]	Halocarbon R22 [2]	R410A [3]	Halocarbon 134a [4]
IUPAC CHEMICAL NAME	**Ammonia**	**Chlorodifluoromethane**	**R-32/125**	**1,1,2,2-Tetrafloroethane**
CHEMICAL FORMULA/ COMPOSITION	NH_3	CHF_2Cl	CH_2F_2 (50%), C_2HF_5(50%)	$C_2H_2F_2$
REFRIGERANT ASHRAE NUMBER	R-717	R-22	R-410A	R-134a
POTENTIAL HEALTH EFFECTS – ACUTE TOXICITY	Corrosive to the eyes, may cause severe damage including blindness. Contact causes severe skin irritation and possible burns. Ingestion causes burns of the upper digestive and respiratory tract. Inhalation of corrosive fumes/ gases may cause coughing, choking, headache, dizziness, and weakness for several hours.	Contact with liquid may cause frostbite. High concentrations may cause asphyxia from lack of oxygen or act as a narcotic causing central nervous system (CNS) depression.	Contact with liquid may cause frostbite. High concentrations may cause asphyxia from lack of oxygen or act as a narcotic causing CNS depression. Intentional misuse and deliberate inhalation may cause death without warning. Higher exposures may cause temporary alteration of the heart's electrical activity or fatality from gross overexposure.	May cause slight irritation to eyes and skin. Contact with liquid may cause frostbite. High concentrations may cause asphyxia from lack of oxygen or act as a narcotic causing CNS depression.
POTENTIAL HEALTH EFFECTS – CHRONIC TOXICITY	Possible risks of irreversible effects. Chronic exposure to corrosive fumes/gases may cause erosion of the teeth and jaw necrosis. Bronchial irritation, with chronic cough and attacks of pneumonia are common. Gastrointestinal disturbances may also be seen.	Possible risks of irreversible effects.	Possible risks of irreversible effects.	Possible risks of irreversible effects. Oxygen deficiency during pregnancy has produced developmental abnormalities in humans and experimental animals.
ECOLOGICAL EFFECTS	Harmful to aquatic organisms. Very toxic to aquatic organisms. Ozone depletion potential.	Product is known to contribute to the destruction of the ozone layer.	The environmental impact of this product has not been fully investigated.	Will not bioconcentrate. Ozone depletion potential.
FREEZING POINT [5]	-77.7°C/ -107.9°F	-160°C/ -245°F	No information available	-101°C/ -149.8°F
BOILING POINT/ BOILING RANGE [5]	-33.3°C/-28.8°F	-40.8°C/ -41.4°F	-51.6°C/ 60.8°F	-26.5°C/ -15.7°F
PHYSICAL STATE	Gas	Compressed gas	Compressed liquefied gas	Compressed gas
WATER SOLUBILITY	Completely soluble	Slightly soluble	No information available	67mg/L at 25°C

Notes

1: *The Linde Group, "Ammonia Material Safety Data Sheet," 2010.*
2: *The Linde Group, "Chlorodifluoromethane (Halocarbon R22) Material Safety Data Sheet," 2010.*
3: *The Linde Group, "R410A Material Safety Data Sheet," 2011.*
4: *The Linde Group, "Tetrafloroethane (Halocarbon 134a) Material Safety Data Sheet," 2010.*
5: Standard conditions: 25°C/77°F and 100kPa/0.987atm

Distribution of Refrigeration Systems in BC

As discussed above, the BPVR Safety Program is responsible for overseeing refrigeration equipment and refrigeration systems, as well as boilers and boiler systems, pressure vessels, pressure piping and pressure piping systems, throughout the equipment life cycle. In addition, BCSA also certifies the operators of these boiler, pressure and refrigeration systems.

The highest population concentrations (or highest population density) occur in BC's lower mainland, southern interior's Okanagan Valley and Vancouver Island's east coast. There are smaller concentrations in central and northern BC. The population density pattern is shown in Figure 3.1-2 and is mirrored not only in the distribution of the 80,000 operating BPVR units, but also in refrigeration units and ammonia refrigeration units as shown in Figures 3.1-3, 3.1-4 and 3.1-5. Appendix A2 provides larger scaled images of ammonia refrigeration units in select regions of BC.

FIGURE 3.1-2:
BC POPULATION DISTRIBUTION - NIGHT VIEW [NOTE 6]

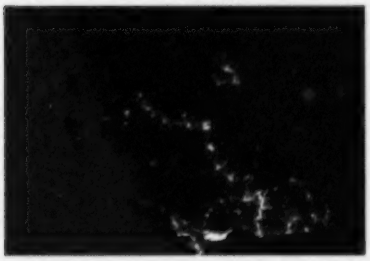


FIGURE 3.1-3: GEOGRAPHIC DISTRIBUTION - ALL BOILER, PRESSURE VESSEL AND REFRIGERATION UNITS [NOTE 7]

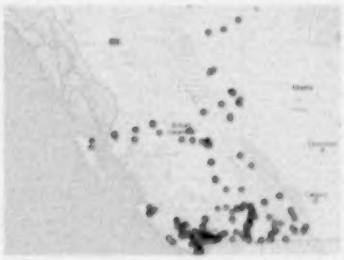


FIGURE 3.1-4:
GEOGRAPHIC DISTRIBUTION - REFRIGERATION UNITS [NOTE 7]

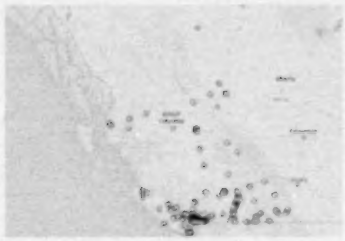
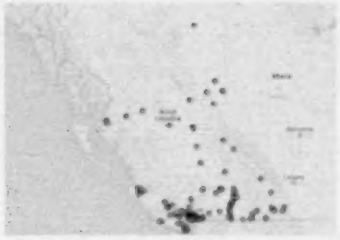


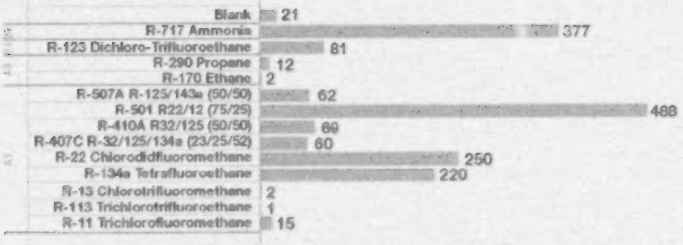
FIGURE 3.1-5
GEOGRAPHIC DISTRIBUTION - AMMONIA REFRIGERATION UNITS [NOTE 7]



Note 6: University of Victoria, BC Atlas of Wellness 2nd Edition, 2011, page 45.
Note 7: BC Safety Authority, September 2014.

FIGURE 3.1-6:
OPERATING BPVR UNITS IN BC

FIGURE 3.1-7: OPERATING REFRIGERATION UNITS BY REFRIGERANT AND SAFETY CLASSIFICATION (NOTE 8)



Note 8: ANSI/ASHRAE 34 Designation and Safety Classification of Refrigerants classifies refrigerants into safety groups.

Figure 3.1-6 compares the quantities of operating boiler, pressure vessel and refrigeration units in BC. Figure 3.1-7 compares the refrigeration units by refrigerants and shows that most refrigeration units utilize methane- or ethane-based refrigerants or methane-ethane-based refrigerant blends.

FIGURE 3.1-8:
BPVR INCIDENTS INVESTIGATIONS (2007-2013)

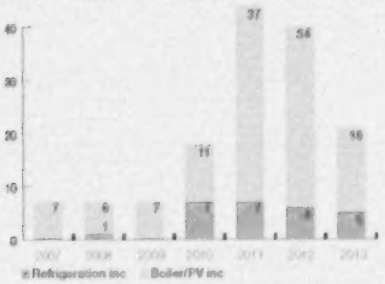


FIGURE 3.1-9: REFRIGERATION INCIDENTS BY REFRIGERANT (2007-2013)

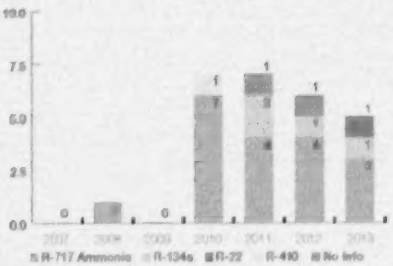


TABLE 3.1-2: REFRIGERANT LISTING

REFRIGERANT NUMBER	IUPAC CHEMICAL NAME
R-717	Ammonia
R-134a	1,1,2,2-Tetrafloroethane
R-22	Chlorodifluoromethane
R-410	R-32/125 (50/50) 50/50 blend of R-32 (Difluromethane) and R-125 (Pentafluoroethane)

Between 2007 and 2013, there were 26 incidents investigated by safety officers where it was reported that a refrigerant was discharged. Figure 3.1-8 compares refrigerant release incidents relative to boiler and pressure vessel incidents investigated by BCSA. Figure 3.1-9 shows refrigeration incidents and reveals that almost 70% of refrigerant incidents reported to BCSA involved systems containing ammonia. Appendix A2 includes a listing of the reported ammonia incidents, a map of the incident locations in BC and maps indicating the distribution of pressure vessels containing ammonia in BC.

FIGURE 3.1-10
AMMONIA RELEASES BY FACILITY (2007-2013)

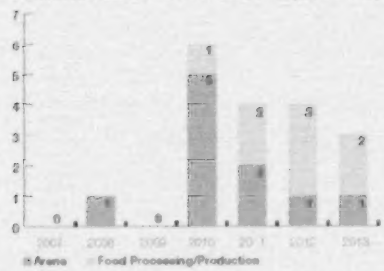


FIGURE 3.1-11
AMMONIA RELEASES AT ARENAS THAT RESULTED IN INJURIES (2007-2013)

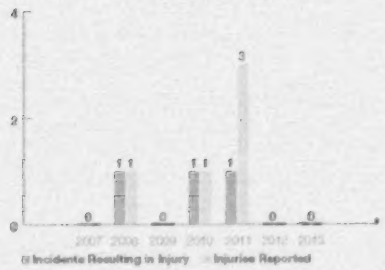
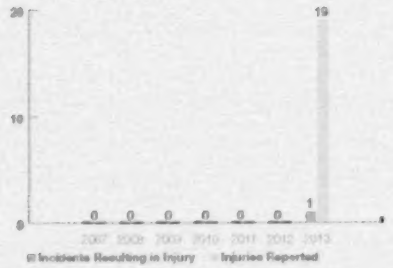


FIGURE 3.1-12 AMMONIA RELEASES AT FOOD PRODUCTION FACILITIES THAT RESULTED IN INJURIES (2007-2013)



Eighteen incidents reported to BCSA resulted in the release of ammonia from the refrigeration system, however only four of these incidents included reports of injuries resulting from the incident. It is important to note that BCSA receives its injury reports from operators or first responders immediately following the incident. Ammonia

exposure-related injuries may develop or the negative effects resulting from exposure may increase some time after the initial reports to BCSA. The following list summarizes the injury reports made to BCSA.

- In 2008, an arena and the surrounding eight blocks were evacuated after an ammonia leak. It was reported that a first responder was exposed to ammonia.
- In 2010, it was reported that a first responder was admitted to hospital after exposure to ammonia gas when responding to an ammonia leak at an arena.
- In 2011, it was reported that three employees received injuries when ammonia refrigerant vapour was released at an arena. It was reported that two employees (operators) walked into ammonia vapour when they walked outside to investigate. The third employee (not an operator) reported exposure to ammonia. Approximately one year after the incident and investigation, BCSA learned indirectly that the third employee's injuries were more serious than initially reported. This employee experienced chronic effects that impacted the employee's respiratory systems.
- In 2013, it was reported that nineteen people were reportedly sent to hospital as a precaution after ammonia was released from a food processing facility. Eighteen of those persons were from a nearby separate facility.

Table 3.1-3 below summarizes the causes and failure descriptions identified by safety officers during their investigations of ammonia release incidents.

TABLE 3.1-3:
SUMMARY OF FACTORS CONTRIBUTING TO AMMONIA RELEASE INCIDENTS

CAUSE CATEGORY	QTY	EQUIPMENT OR OPERATION FAILURE DESCRIPTION
Equipment failure	4	Control or monitoring system failure
	4	System component failure
	2	Corrosion
	1	Tool failure
Not indicated	2	Not recorded
Operating procedure	1	Lubricant (oil) transfer
	1	Refrigerant transfer
Installation	1	System-component compatibility
	1	Valve not secured
Weather	1	Frozen water supply line

Ammonia Incident and Injury Summary

The number of BPVR incidents reported to BCSA is generally inconsistent between 2007 and 2010. BCSA has been actively working with these industry sectors to improve reporting which it believes is the likely reason for the increase in reported incidents starting in 2010.

Between 2007 and 2013, there were 18 reported ammonia releases and four of these incidents resulted in 24 reports of ammonia exposure. There are numerous contributing factors identified as being associated with the ammonia release as identified in Table 3.1-3. Most ammonia releases are associated with failures of control/monitoring systems or individual system components.

The reported ammonia releases occurred at recreational facilities (arenas) and food production/processing facilities. Although there are exceptions, exposure and injuries are typically reported to be associated with the employees of facilities using ammonia or first responders attending to the incident.

ASSESSMENTS OF REGULATED WORK

BPVR safety officers assess new installations as well as operating equipment as part of BCSA's enforcement of the *Safety Standards Act*. These physical assessments provide BCSA and its stakeholders with an understanding of strengths and weaknesses within the safety system and inform priorities for prevention, assessment and audit efforts. During each physical assessment of regulated work, safety officers identify whether the work complies with the act, regulations and technical codes as well as identify hazards. These 'as-found' hazards reflect what the safety officers discovered when they initially observed the duty holders' work or equipment, and not the condition following completion of the interaction with the safety officer. A summary of SEVERE and MAJOR hazards found between October 1, 2014 and December 31, 2014 is provided in Appendix B, along with the hazard rating scale.

FIGURE 3-3:
BPVR PERMITS
2010-2014

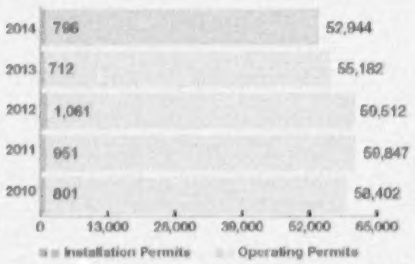


FIGURE 3-4:
BPVR PHYSICAL
ASSESSMENT
RESULTS IN 2014

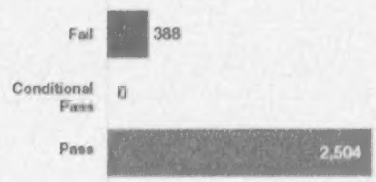
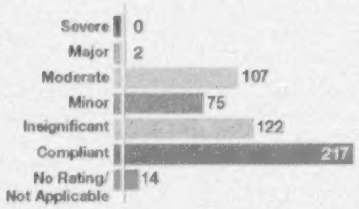


FIGURE 3-5:
HAZARDS RECORDED
IN Q4-2014



The BPVR Safety Program conducts assessments on both newly installed boilers, pressure vessels and refrigeration plants, as well as periodically throughout the operating life of the equipment. The periodic assessment schedule for operating pressure equipment is established through a resource allocation program which takes into consideration parameters including, but not limited to, the type of equipment, its size, type of occupancy where it is installed and the last assessment date, to determine what equipment may represent a higher risk. Equipment that is prioritized by the resource allocation program is scheduled for an assessment to evaluate regulatory compliance. The number of physical assessments for 2014 is a total of both new installation and periodic operating assessments. The total number of permits issued in 2014 represents a slight decrease from the number issued in 2013. The results of physical assessments performed in 2014 show a failure rate of approximately 14%. The 'as-found' conditions observed during the assessments conducted in Q4 of 2014 identified 2 major hazards involving regulated equipment. In both cases, the permit holder was notified of the hazardous conditions which initiated corrective actions by the permit holder to resolve the hazards.

Managing Boilers, Pressure Vessels and Refrigeration Safety Risks

STAKEHOLDER ENGAGEMENT

BCSA consulted the BPVR technology on changing their hourly rate for design registrations to a standardized fee, based on the complexity of the submission and level of effort required to process the design. The new fees, beginning in 2015, will facilitate better project planning and cost predictability for clients.

The Boilers, Pressure Vessels and Refrigeration Technology Advisory Committee met four times in 2014, and established two Working Groups to address the following technical safety and regulatory improvement issues:

- Quality control manual for refrigeration contractors.
- Power Engineers, Boiler, Pressure Vessel and Refrigeration Safety Regulation review.

Two sub-committees have also been formed to address longer-term issues in industry:

- The Refrigeration Sub-Committee was established to identify and work through technical safety issues for refrigeration system owners and licensed contractors. This sub-committee submitted a number of recommendations this year to improve consistency in safety officer assessments.
- The Education Sub-Committee was established to identify and work through educational issues, including the submission of new examination questions to augment the Standardization of Power Engineer Examinations Committee's (SOPEEC) question bank.

CLIENT EDUCATION EVENTS

BCSA conducted two Boiler Tech Talks and five information sessions throughout the province in 2014, reaching 76 stakeholders. More details of each session can be found in Appendix F.

TABLE 3-2: BPVR EDUCATION EVENTS CONDUCTED IN 2014

TITLE / TOPIC	Qty of Participants
Welder Qualifications	2
Welding Procedures	26
Refrigeration regulations, codes and standards	9
Alterations and Repairs	6
Introduction to BCSA (PE)	8
Prescriptive Regulation (Shell Calgary)	10
Total	**61**

MEDIA RELATIONS

BCSA managed seven media relations actions in 2014 related to BPVR safety. A listing of all media relations activities can be found in Appendix G.

LICENSING AND CERTIFICATION

BCSA undertakes activities to verify that regulated equipment is installed by licensed contractors and operated and maintained by qualified individuals. In 2014, 71 new contractor licences and 872 certificates of qualification were issued to individuals that demonstrated the required capabilities to produce safe work.

TABLE 3-3: NEW BPVR LICENCES AND CERTIFICATES OF QUALIFICATION ISSUED

TYPE	DOCUMENT	Qty Issued in 2014	Qty Issued in 2013
Licence	Contractor Licence	71	73
Certificate of Qualification	1st Class Power Engineer	20	7
	2nd Class Power Engineer	48	45
	3rd Class Power Engineer	113	106
	4th Class Power Engineer	349	312
	5th Class Power Engineer	29	40
	Ice Facility Operator	59	82
	Refrigeration Operator	49	55
	Boiler Safety Awareness	29	26
	Refrigeration Safety Awareness	63	100
	Antique Show Boiler Operator – Traction Engine	2	2
	Oil well Boiler Operator	111	108

Exam Results

In addition to obtaining the required experience, individuals must pass the relevant exam (or a series of exams) to obtain a certificate of qualification. These exams help to reinforce the importance of duty holders demonstrating they have appropriate safety knowledge before working in areas where their decisions have the potential to affect the safety of others. These requirements are detailed in the *Safety Standards Act* and regulations. In 2014, there were 2,060 BPVR exams taken.

This year's State of Safety Report includes the distribution of exam marks relative to the pass/fail grade to inform discussions and planning around qualifications of workers subject to the *Safety Standards Act*.

TABLE 3-4: BPVR EXAM RESULT DISTRIBUTION

EXAM	QTY EXAMS	PASS RATE (%)	DISTRIBUTION OF RESULTS
All Boilers, PV, Refrigeration exams taken in 2014	2,060	77%	
1ST Class Power Engineer	66	65%	
2ND Class Power Engineer, 2ND Class Power Engineer (BC)	273 [Note 1]	69%	
3RD Class Power Engineer	592	76%	
4TH Class Power Engineer	837	81%	
5TH Class Power Engineer	34	71%	
Boiler Safety Awareness (BC)	27	78%	
Ice Facility Operator	73	84%	
Refrigeration Operator	87	56%	
Refrigeration Safety Awareness (BC)	71	79%	

Note 1: BCSA is subject to the Freedom of Information and Protection of Privacy Act. Provincial legislation restricts the information that may be published where individuals may be identified; accordingly where there are nine or fewer exams written in an exam type, the results and distribution are combined with other exam types.

In Table 3-4 above, the blue area represents the distribution of the quantity of exams written and marked in 2014 relative to the pass/fail grade (red line). The range of the horizontal axis (x-axis) is from 0% to 100% and is divided equally in 5% increments. The pass/fail grade is 65% for BPVR exams. A noticeable shift around the pass/fail line can be observed as a result of allowances for errors in examination results.

ENFORCEMENT ACTIONS

The following table summarizes the enforcement actions taken in the BPVR sector in 2014. A listing of all compliance orders is included in Appendix C.

TABLE 3-5: BPVR ENFORCEMENT ACTIONS

	WARNING NOTICES	COMPLIANCE ORDERS	SANCTIONS
No contractor license	0	2	0

REGULATORY INSTRUMENTS AND AMENDMENTS

BCSA issues safety orders, directives and information bulletins to stop unsafe activity and provide clarification of regulatory requirements and interpretations. Additional details can be found in Appendix D or at www.safetyauthority.ca.

TABLE 3-6: BPVR REGULATORY INSTRUMENTS

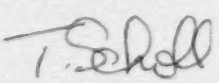
TYPE	DOC. NO.	TITLE / DESCRIPTION
Directive	D-BP- 2014-01	Applications for Third Class Power Engineer's Certificate of Qualification
Bulletin	IB-BP-2014-01	Boiler and Pressure Vessel Codes Adopted
Bulletin	IB-BP-2014-02	Design Registration – Changes to BCSA's Application Process
Recommendation For Amendment	N/A	Adoption of new editions of boiler and pressure vessel codes
Amendment	N/A	Adoption of new editions of boiler codes
Directive	D-B6 070101 1 Revision 4	Incident reporting requirements with respect to the Boiler, Pressure Vessels and Refrigeration technology

SAFETY MANAGER'S DISCUSSION

BCSA is committed to improving the effectiveness of the safety oversight provided through the administration of the *Safety Standards Act* and referenced regulations. In 2014, BCSA commenced a review of the *Safety Standards Act* (the Act) and the Power Engineers, Boiler, Pressure Vessel and Refrigeration Safety Regulation (PEBPVR Regulation). The overall purpose of the review is to ensure that the Act and PEBPVR Regulation are relevant and up to date and that requirements can be effectively administered by BCSA and complied with by the affected stakeholders. The review process will include a regulatory impact assessment and consultation with stakeholders to allow comments to be submitted on any proposed amendments, prior to any changes being made.

The interest in liquefied natural gas (LNG) as a clean burning fuel continues globally, particularly in emerging economies. The province of BC is in a position to supply this market, due to large deposits of natural gas. A number of LNG plants are being considered for construction in the coastal regions of BC. The purpose of the LNG plant is to process the gas and convert it from a gaseous state to a liquid state. Once liquefied, the natural gas would then be loaded on to ships for export. In 2014, BCSA supported this interest in LNG by participating in a number of on-going meetings with stakeholders and other regulatory agencies. The objective of these meetings, in part, was for BCSA to provide a better understanding to stakeholders of the current regulatory and technical requirements that are applicable to the design, construction, assessment and operation of the proposed LNG plants. Applicable requirements of the PEBPVR Regulation, Gas Safety Regulation and Electrical Safety Regulation were considered, as well as alternatives available under the Alternative Safety Approaches Regulation. BCSA is also participating in the development of revised technical standards to address the specific construction and operational requirements of modern LNG plants.

The number of incidents reported in 2014 is relatively the same as for 2013. The most common incident that is being reported is the release of ammonia to the atmosphere. Although there was minimal property damage as a result of these incidents, a total of four injuries were attributed to exposure to ammonia gas released from refrigeration plants. Moving forward, BCSA has commenced a number of initiatives with the goal of reducing the risk of ammonia releases. These initiatives include: targeted communications to owners and users regarding the hazards of ammonia; investigation of all incidents involving ammonia releases to determine the root causes; corrective actions to resolve non-compliances; and the application of enforcement actions if warranted. BCSA assessments of ammonia refrigeration plants located in ice arenas continue to be a priority. These actions are being taken to support public safety and BCSA's vision of *Safe Technical Systems. Everywhere.*

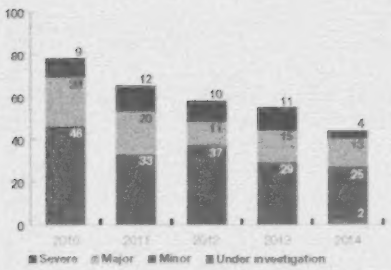


Tony Scholl
Boilers, Pressure Vessels and Refrigeration Safety Manager

Understanding Gas Safety Risks

In the Gas Safety Program at BC Safety Authority (BCSA), we are responsible for overseeing industrial and commercial use of natural gas, propane, digester gas, manufactured gas, liquefied petroleum gas, landfill gas and hydrogen throughout British Columbia in accordance with the *Safety Standards Act* and the Gas Safety Regulation. We are responsible for delivering gas safety services for approximately 1.2 million homes in BC. Municipalities that have separate administrative agreements with the Province to oversee low pressure gas systems and work are identified in Appendix H.

FIGURE 4-1:
GAS INCIDENT REPORTS 2010-2014



INCIDENTS

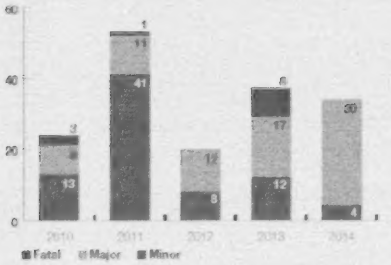
The following summarizes incidents reported to BCSA involving regulated gas equipment.

TABLE 4-1: SEVERE AND MAJOR GAS INCIDENTS IN 2014

Rating	Qty	Description
SEVERE	2	Gas leaks
	1	Elevated carbon monoxide
	1	Fire where regulated equipment or work was suspected to be involved
MAJOR	6	Explosions and fires where regulated equipment or work was involved or suspected to be involved
	5	Elevated carbon monoxide
	1	Underground gas line damaged (line hit)
	1	Unsafe condition reported (meter observed dangling)

Since 2010, there has been a small, steady decline in the number of gas related incidents reported to BCSA. In 2014, there were noticeably fewer gas related SEVERE and MAJOR fires or explosions involving gas equipment. Most MINOR incidents were related to fires or carbon monoxide exposures. A more detailed summary of incidents is included in Appendix A1.

FIGURE 4-2: INJURIES REPORTED 2010-2014 [NOTE 1]



Note 1: BCSA receives its injury reports and descriptions from operators or first responders at the time of, or immediately following, the incident. Injuries may develop after the initial reports were made to BCSA and the long term effects of a resultant injury may not be recorded as part of the BCSA investigation.

INJURIES

TABLE 4-2: MAJOR INJURIES REPORTED IN 2014 [NOTE 1]

Rating	Qty	Description
MAJOR	30	Carbon monoxide exposure

In 2014, there were twice as many carbon monoxide (CO) exposures as reported in the previous year. One incident was reported to have affected 15 people and accounts for the increase in reported injuries.

Given the persistent number of incidents and injuries related to carbon monoxide exposure as well as to supplement BCSA's ongoing campaign for carbon monoxide awareness, this year's annual State of Safety Report includes a summary of the previous seven years of carbon monoxide incidents and injuries reported to BCSA.

CARBON MONOXIDE INCIDENTS (2007 TO 2013)

Carbon monoxide (CO) is a poisonous gas that is colourless, odourless and tasteless. If inhaled in sufficient quantities, CO can interfere with the body's ability to absorb oxygen. At low concentrations, symptoms of CO poisoning present similar to flu symptoms: headaches, nausea, fatigue and dizziness. In higher concentrations or prolonged exposure, symptoms can worsen and cause loss of consciousness and death.

Carbon monoxide exists naturally in the atmosphere in small concentrations and is also a combustion by-product of carbon-based fuels. CO is produced when the combustion of a carbon-based fuel is incomplete, usually due to insufficient oxygen during the combustion process. Balanced fuel and air mixtures can minimize the amount of CO produced during combustion while venting combustion gasses to the atmosphere prevents CO build-up from occurring in enclosed spaces.

FIGURE CO-1:
BASIC COMBUSTION DIAGRAM

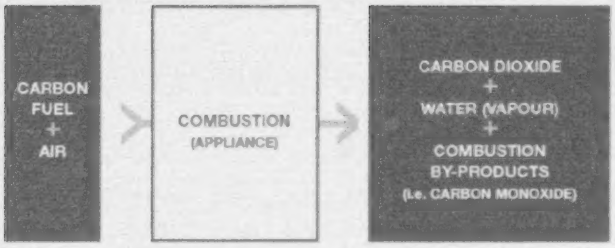
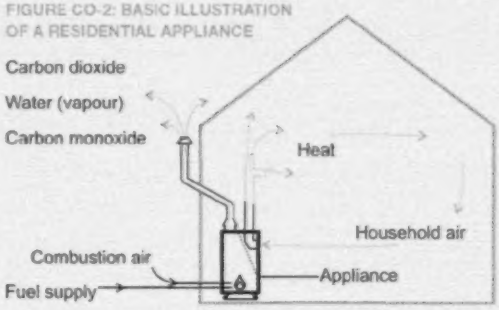


FIGURE CO-2: BASIC ILLUSTRATION OF A RESIDENTIAL APPLIANCE



Over the years, BCSA observed incidents involving regulated equipment that resulted in CO poisoning resulting in fatalities and other non-fatal injuries. CO poisoning incidents usually result from one or both of the following two conditions being present:

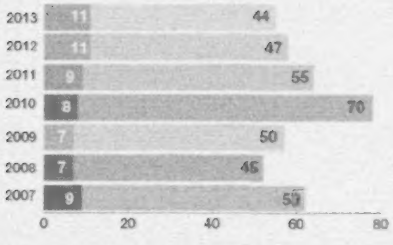
1. A failure to effectively vent the products of combustion away from enclosed, occupied spaces, and/or
2. Excess CO being produced by fuel burning appliances.

This case study provides an overview of the incidents involving CO that were reported to and investigated by safety officers occurring from January 1, 2007 to December 31, 2013. It is important to note that BCSA does not regulate all fuels that produce CO, therefore occurrences involving fuels not regulated by BCSA are not considered in this review.

Investigations by BCSA

A total of 62 incidents were reported and investigated between 2007 and 2013. These incidents resulted in nine fatalities and 110 non-fatal injuries. A listing of the incidents is included in Table A4-1 (Appendix A4).

FIGURE CO-3: INCIDENTS INVESTIGATED BY GAS SAFETY OFFICERS



Note: The saturated (dark) colour represents CO incidents, and the lighter colour indicates other gas incident investigations.

FIGURE CO-4: CARBON MONOXIDE INCIDENTS INVESTIGATED BY MONTH AND YEAR

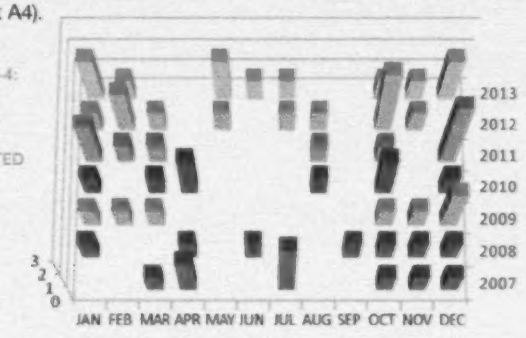
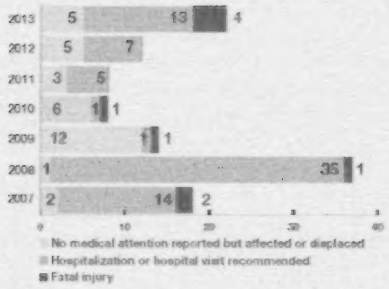


FIGURE CO-5: INJURIES RESULTING FROM CO INCIDENT INVESTIGATIONS


2013 5 13 4
2012 5 7
2011 3 5
2010 6 1 1
2009 12 1 1
2008 1 35 1
2007 2 14 2
0 10 20 30 40
No medical attention reported but affected or displaced
Hospitalization or hospital visit recommended
Fatal injury

Notes:

1) The categorization of the non-fatal injuries in Figure CO-5 differs from the categorization used in the remainder of the State of Safety Report. (ie., Carbon monoxide injuries are usually classified as 'major injuries').

2) BCSA receives its injury reports and descriptions from operators or first responders at the time of, or immediately following, the incident. Injuries may develop after the initial reports were made to BCSA and the long term effects of a resultant injury may not be recorded as part of BCSA's investigation.

There is little variation in the number of carbon monoxide incident investigations from 2007 to 2013. Carbon monoxide incident investigations represent 62 of the 426 gas-related incidents investigated by BCSA's safety officers. Figure CO-4 shows the distribution of CO incident investigations by month and illustrates that most of the CO-related incidents occurred from October to April.

During this seven year period, CO incidents resulted in nine fatalities and 110 non-fatal injuries. In June 2008, one incident resulted in 27 employees at an industrial facility where the investigation stated the employees were taken to hospital and found to have CO poisoning.

Most incidents occurred in residences and involved residential furnaces or water heaters. Each investigation identified at least one appliance that produced, or may have produced, carbon monoxide.

FIGURE CO-6: STRUCTURES WHERE CO INCIDENTS OCCURRED

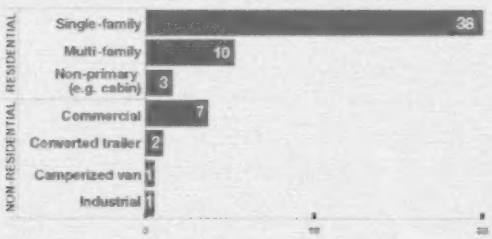
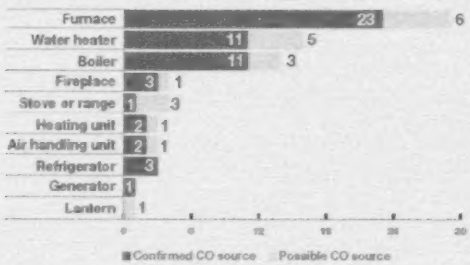


FIGURE CO-7: SOURCES OF CARBON MONOXIDE



Note: Some investigations identified multiple appliances that may have produced CO, yet did not confirm which was most likely the CO source; therefore, the total number of appliances exceeds the number of events. For example: there were 29 incidents that identified furnaces for potential involvement. In 23 of these 29 cases, the investigation confirmed that the furnace was the source of excess CO. In the remaining six cases, the investigation could not confirm that the furnace produced excess CO, or the investigation identified that there were other appliances (in addition to the furnace) that could have produced excess CO.

Investigation activities focus on understanding the relationship between regulated work or regulated equipment and the factors that may have contributed to the cause of the event. Factors contributing to the CO incident occurrences are summarized in Table CO-1 below. Additional details are available in Table A4-1 (Appendix A4).

TABLE CO-1: SUMMARY OF FACTORS CONTRIBUTING TO CO INCIDENTS

QTY OF EVENTS	CAUSES AND CONTRIBUTING FACTORS THAT ATTRIBUTED TO THE INCIDENT
20	Ventilation and inability to vent combustion products
11	Service, maintenance and/or equipment replacement
9	Equipment or component failures
8	Installation issues
5	Investigations were inconclusive [Note 1]
4	Unqualified persons performing regulated work
3	Unsafe use of equipment
1	Poor air-gas ratio
1	Wind creating a downdraft

Note 1: Although elevated CO was observed, the investigation was either unable to determine the cause or unable to rule out the involvement of regulated equipment.

Carbon Monoxide Incident and Injury Summary

This summary provides a general overview of the CO-related incidents reported to and investigated by BCSA. From 2007 to 2013, there were 62 incidents resulting in nine fatalities and 110 non-fatal injuries. Most CO incidents occurred during October to April. Most incidents occurred in residences and involved residential furnaces or water heaters as the source of CO while ineffective venting and maintenance were identified as the most prevalent contributing factors.

This summary highlights the importance of proper installation and regular maintenance of residential fuel burning appliances and their venting systems. It also illustrates the importance of using CO detectors in homes that incorporate fuel burning appliances. In 2011, BCSA launched an initiative focused on generating awareness around the hazards associated with CO poisoning and how to reduce those hazards and prevent future incidents. This awareness campaign, called "Be in the Know About CO", continued through 2014. More information on the carbon monoxide public awareness initiatives can be found in the following section Managing Gas Safety Risks and on our website at: http://www.safetyauthority.ca/be-in-the-know.

ASSESSMENTS OF REGULATED WORK

Gas safety officers assess new installations as well as operating equipment as part of BCSA's enforcement of the *Safety Standards Act*. These physical assessments provide BCSA and its stakeholders with an understanding of strengths and weaknesses within the safety system and inform priorities for prevention, assessment and audit efforts. During each physical assessment of regulated work, safety officers identify whether the work complies with the act, regulations and technical codes as well as identify hazards. These 'as-found' hazards reflect what the safety officers discovered when they initially observed the duty holders' work or equipment, and not the condition following completion of the interaction with the safety officer. A summary of SEVERE and MAJOR hazards found between October 1, 2014 and December 31, 2014 is provided in Appendix B, along with the hazard rating scale.

FIGURE 4-3:
GAS PERMITS 2010-2014

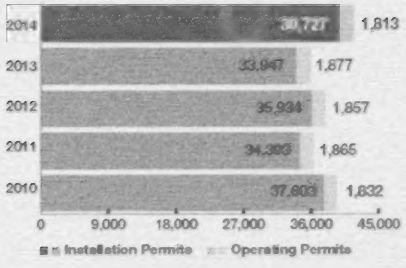


FIGURE 4-4:
GAS PHYSICAL ASSESSMENT RESULTS IN 2014

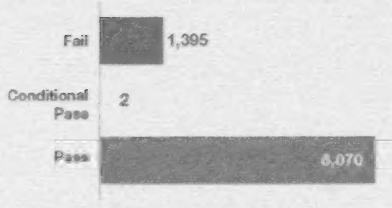
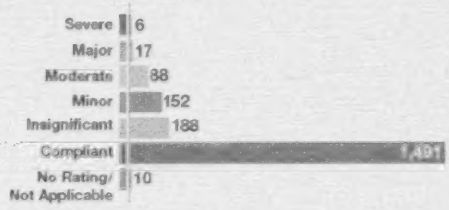


FIGURE 4-5:
HAZARDS RECORDED IN Q4-2014



BCSA's Resource Allocation Program (RAP) provides a first level filtering of installation permit factors for assessment. RAP considers factors such as past history of compliance, scope of gas work, type of equipment installed, type of occupancy, and the period since the last assessment was conducted. This provides a guide to the gas safety officer regarding the prioritization of physical assessments. Collecting and integrating 'as-found' conditions information when a physical assessment is performed provides BCSA with a snapshot of existing non-compliances. BCSA will audit 'as-found' information to determine if further RAP refinement is needed to best determine where to deploy resources. We continue to monitor non-compliance trends from recorded assessment reports in order to develop mitigation plans and encourage improvement through various methods, including creating new risk registry items with associated control measures.

Managing Gas Safety Risks

STAKEHOLDER ENGAGEMENT

To help avoid misinterpretations and administrative errors on gas installation permit fees, BCSA consulted on combining gas appliance installation permit fees for multi-family dwellings and single family dwellings into a single fee schedule. The new fee schedule will be effective in 2015.

Preliminary consultation sessions were held throughout the year to engage the propane industry in bringing all propane tanks into regulatory compliance through a registration process. It is anticipated that 2015 will see further consultation with the propane industry on this issue.

The Gas Technology Advisory Committee met four times in 2014, and established two working groups to address the following regulatory improvement, technical safety and service delivery issues:

- Establishing requirements for field safety representatives in the gas technology.
- Review of requirements for limited gas product approvals such as prototype certification, which was formerly called the File 25 program.

The Gasfitter Apprenticeship Working Group's work was put on hold while the National Occupational Analysis and creation of exam banks were underway, in preparation for the establishment of a national red seal program for gasfitters. The Gas Safety Regulation Review Working Group and the Small Gas Distribution Systems Working Group began making progress toward their goals. In addition, two working groups reporting to the Gas Technology Advisory Committee concluded their work:

- The Gasfitter Bursary Working Group disbanded after the work was relegated to an external committee.
- The Limited Gas Product Approvals Working Group, as described above, submitted their final recommendation to define cases in which this type of approval can be used, set limits on the number of products that can be manufactured under a single approval, and outline other requirements.

The gas safety managers of the Safety Standards Administrators' Group met three times in 2014 to discuss how to improve consistency among the various authorities having jurisdiction over gas safety in BC. While the Incident Reporting Working Group submitted their final recommendations in 2013 for a consistent incident reporting format for all municipalities toward a common incident report, the online tool for this was created in 2014. There are plans for improving this online tool for 2015 with the goal of generating a report that provides a complete picture of gas incidents across BC, and using this information to better identify trends.

COLLABORATING WITH CLIENTS ON SAFETY

In 2014, BCSA partnered with the Canadian Propane Association to develop co-branded carbon monoxide safety tags for 20lb propane cylinders across the province. During the pilot project, tags were attached at the point of fill across BC. In the future, carbon monoxide safety tags for propane tanks will have an annual projected distribution of over 500,000 annually.

Client Education Events

BCSA conducted eight Gas Tech Talks and participated on one panel discussion throughout the province in the first quarter of 2014, covering four topics and reaching 160 stakeholders. More details of each Tech Talk can be found in Appendix F.

TABLE 4-3: GAS EDUCATION EVENTS CONDUCTED IN 2014

TITLE / TOPIC	Qty of Participants
Introduction to BCSA	138
Plastic Venting	101
JARTS Refrigeration Training	30
Design Registration	50
Fairs and Festivals / Food Carts	45
My Connection Breakfast	15
Gas Panel - Boiler Permitting Requirements	15
Gas Online Forum	6
Navigating Education Pipelines in the Gas Industry Conference	100
Total	**500**

MEDIA RELATIONS

BCSA managed 28 media relations actions in 2014 related to gas safety. A listing of all media relations activities can be found in Appendix G.

LICENSING AND CERTIFICATION

BCSA requires that gas equipment is installed, operated and maintained by qualified and knowledgeable professionals. In 2014, 284 new contractor licences and 810 certificates of qualification were issued.

TABLE 4-4: NEW GAS LICENCES AND CERTIFICATES OF QUALIFICATION ISSUED

TYPE	DOCUMENT	Qty Issued in 2014	Qty Issued in 2013
Licence	Contractor Licence	284	260
Certificate of Qualification	Class A Gas Fitter	100	62
	Class B Gas Fitter	275	211
	Class B Gas Fitter – GP	234	376
	CNG Automotive Technician	29	26
	CNG/LPG Automotive Technician	9	2
	Gas Appliance Service Technician	31	53
	LPG Automotive Technician	14	5
	Gas Utility Technician	2	10
	RV Gas Installation and Service Technician	4	10
	Special Purpose Gas Certificate	112	17

Exam Results

In addition to obtaining the required experience, individuals must pass the relevant exam (or a series of exams) to obtain a certificate of qualification. These exams help to reinforce the importance of duty holders demonstrating they have appropriate safety knowledge before working in areas where their decisions have the potential to affect the safety of others. These requirements are detailed in the *Safety Standards Act* and regulations. In 2014, there were 803 gas exams taken.

This year's State of Safety Report includes the distribution of exam marks relative to the pass/fail grade to inform discussions and planning around qualifications of workers subject to the *Safety Standards Act*.

TABLE 4-5: GAS EXAM RESULT DISTRIBUTION

EXAM	QTY EXAMS	PASS RATE (%)	DISTRIBUTION OF RESULTS
All gas exams taken in 2014	803	88%	
Class A Gas Fitter	116	95%	
Class B Gas Fitter	409	93%	
Class B Gas Fitter GP	150	87%	
CNG Automotive Technician	34	76%	
Gas Appliance Service Technician	53	55%	
LPG Automotive Technician	13	92%	
CNG and LPG Automotive Technician, Gas Utility Technician, RV Installation and Service Technician, Local Gas Safety Officer, Provincial Gas Safety Officer	28 [Note 1]	75%	

Note 1: BCSA is subject to the Freedom of Information and Protection of Privacy Act. Provincial legislation restricts the information that may be published where individuals may be identified; accordingly, where there are nine or fewer exams written in an exam type, the results and distribution are combined with other exam types.

In Table 4-5 above, the blue area represents the distribution of the quantity of exams written and marked in 2014 relative to the pass/fail grade (red line). The range of the horizontal axis (x-axis) is from 0% to 100% and is divided equally in 5% increments. The pass/fail grade is 70% for gas exams. A noticeable shift around the pass/fail line can be observed as a result of allowances for errors in examination results.

ENFORCEMENT ACTIONS

The following table summarizes the enforcement actions taken in the Gas sector in 2014. A listing of all compliance orders and sanctions is included in Appendix C.

TABLE 4-6: GAS ENFORCEMENT ACTIONS

	WARNING NOTICES	COMPLIANCE ORDERS	SANCTIONS
Expired contractor licence	0	4	0
Failure to comply with a compliance order	0	0	1
No contractor licence	0	15	0
No Permit	50	2	0
Outstanding non-compliance(s)	0	1	0
Performing regulated work without the required permission	3	0	1
Use of unqualified workers	0	1	0
Use or disposal of uncertified products	0	1	0

REGULATORY INSTRUMENTS AND AMENDMENTS

BCSA issues safety orders, directives and information bulletins to stop unsafe activity and provide clarification of regulatory requirements and interpretations. Additional details can be found in Appendix D or at www.safetyauthority.ca.

TABLE 4-7: GAS REGULATORY INSTRUMENTS

TYPE	DOC. NO.	TITLE / DESCRIPTION
Directive	D-GA 2014-01	*Safety Standards Act* & Gas Regulation – Liquid Natural Gas Dispensing Site Requirements
Bulletin	B-GA 2014-01	Pipe Welding Requirements for Gas Installations
Directive	D-GA 2014-02	Mobile Outdoor Food Service Equipment Gas Approval Requirements
Directive	D-GA 2014-03	Compressed Natural Gas Fueling Site Requirements
Directive	D-GA 2104-04	Appliance Air Intake Clearance From Regulator / Over Pressure Relief Device Vent Outlet
Directive	D-G5 051206 7 Revision 02	Retail Propane Refueling Stations
Bulletin	B-G5 051206 4 Revision 2	Clearance to Regulator / Over Pressure Relief Device
Directive	D-GA 2014-05 Revision 01	Obsolete / Replacement - Gas Appliance Parts / Components
Directive	D-G5 051201 2 Revision 04	Approved Certification Marks for Gas Appliances
Bulletin	B-GA 2014-02	Assembly of Canadian Certified Portable Natural Gas & Propane Barbeques / Appliances

SAFETY MANAGER'S DISCUSSION

In 2014, the Gas Safety Program introduced the use of an "As-found Hazard Map", a tool that describes and applies a rating value to possible conditions found by safety officers during physical assessments. This tool provides a standard for reporting on industry created risks. Focus is aimed at safety hazards found versus code violations. Patterns can be observed promptly due to the frequency of report generation thereby providing the necessary information in order to correct behaviors or conditions in a timely fashion, for example by issuing a directive or bulletin.

As gasfitting moves towards a "Red Seal" designation, a trade separate from traditional piping trade's qualifications (e.g., plumbing or steamfitting), the Gas Safety Program initiated a plan for creating a field service representative (FSR) for gasfitting for 2014. This plan will continue to develop in 2015 through support of an industry working group which will provide recommendations to the gas program in order to shape the scope and role of the future gas field service representative.

The 2015 B149 CSA Code series drafts were completed in 2014 and will be balloted in the first part of 2015 for acceptance by the technical committees and the Interprovincial Gas Advisory Committee. Once passed, CSA can finalize and publish the code for a targeted release date set for the summer of 2015.

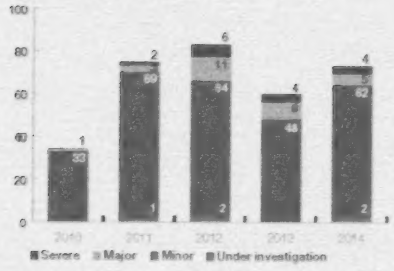
Be in the Know About CO is a BCSA education program aimed at decreasing the number of carbon monoxide related poisonings and deaths in BC. In order to increase awareness of CO safety, BCSA directly targets individuals at highest risk of incident with key CO poisoning prevention information and messaging about the appropriate use of equipment. In 2014, BCSA and the BC Canadian Propane Association Committee agreed to collaborate on a 20lb Propane Cylinder Tag pilot project that would feature point-of-use (cylinder) messaging aimed at increasing safety awareness and consumer confidence using liquefied propane gas (LPG) for home and recreation. The messaging on the tags featured safety tips and imaging focused on four key areas of concern related to location and use. Feedback from pilot participants has been positive to date with a request from another province to potentially adopt the program as well.

Brian Zinn
Acting Gas Safety Manager

Understanding Elevating Devices Safety Risks

In the Elevating Devices (ED) Safety Program at BC Safety Authority (BCSA), we are responsible for overseeing the safety of elevators, escalators, moving walkways, dumbwaiters, lifts and construction hoists in accordance with the *Safety Standards Act* and the Elevating Devices Safety Regulation.

FIGURE 5-1:
ED INCIDENT REPORTS 2010-2014



INCIDENTS

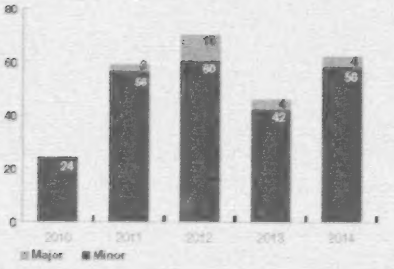
The following summarizes incidents reported to BCSA involving regulated elevating devices.

TABLE 5-1: SEVERE AND MAJOR ED INCIDENTS IN 2014

Rating	Qty	Description
SEVERE	1	Slip and fall on escalator
	1	Reported elevator hard start
	1	Elevator over-speed
	1	Regulated work performed by unlicensed contractor
MAJOR	5	Slips, falls and other unintended contact with elevators or escalators

The number of incidents reported to BCSA is generally consistent with the previous years. There were four SEVERE incidents reported in 2014 and five MAJOR as indicated above. MINOR incidents were related to unintended contact with elevating devices (such as trips, falls and unintended door closures). A summary of incidents is included in Appendix A1.

FIGURE 5-2: INJURIES REPORTED 2010-2014 [NOTE 1]



Note 1: BCSA receives its injury reports and descriptions from operators or first responders at the time of, or immediately following, the incident. Injuries may develop after the initial reports were made to BCSA and the long term effects of a resultant injury may not be recorded as part of BCSA's investigation.

INJURIES

Injuries reported as a result of elevating device incidents are summarized below.

TABLE 5-2: MAJOR INJURIES REPORTED IN 2014 [NOTE 1]

Rating	Qty	Description
MAJOR	4	(Possible) fractures and other injuries requiring hospital treatment

The numbers and types of injuries reported is generally consistent with previous years and associated with slips, trips and falls on elevating equipment. MINOR injuries consisted of pain, lacerations and soft tissue damage resulting from falling on or contact with escalators and elevators.

ASSESSMENTS OF REGULATED WORK

Elevating devices safety officers assess new installations as well as operating equipment as part of BCSA's enforcement of the *Safety Standards Act*. These physical assessments provide BCSA and its stakeholders with an understanding of strengths and weaknesses within the safety system and inform priorities for prevention, assessment and audit efforts. During each physical assessment of regulated work safety officers identify whether the work complies with the act, regulations and technical codes as well as identify hazards. These 'as-found' hazards reflect what the safety officers discovered when they initially observed the duty holders' work or equipment, and not the condition following completion of the interaction with the safety officer. A summary of SEVERE and MAJOR hazards found between October 1, 2014 and December 31, 2014 is provided in Appendix B, along with the hazard rating scale.

FIGURE 5-3:
ED PERMITS 2010-2014

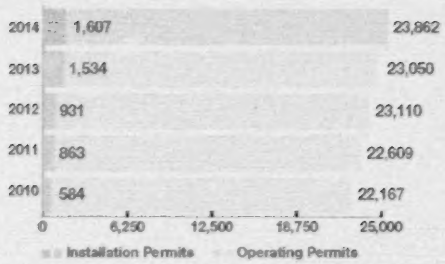


FIGURE 5-4:
ED PHYSICAL ASSESSMENT RESULTS IN 2014

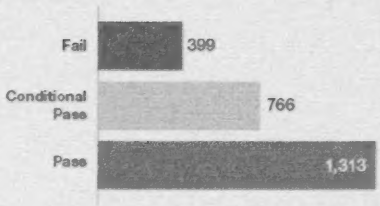
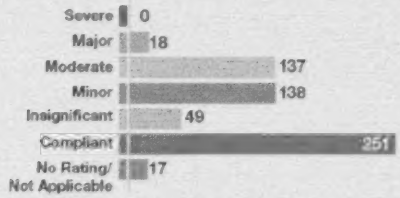


FIGURE 5-5:
HAZARDS RECORDED IN Q4-2014



From a total of 2,646 physical assessments 740 were on operating or in-service units. Safety officers focused on the higher risk occupancy buildings such as hospitals and shopping malls. A Resource Allocation Program (RAP) was developed and implemented in order to assist the safety officers in this task. In conjunction with assessing in-service units, we also conducted contractor declaration audits. By completing and submitting a declaration, which contains critical safety device examination and testing information (required annually or at an interval specified by the *Safety Standards Act*), contractors are declaring the elevating device is safe to operate. Learning from the assessment and audit of operating units is that mandatory maintenance requirements, as required by regulation, were not consistently performed due to lack of awareness and understanding by owners, contractors and maintenance personnel. With the implementation of the Elevating Devices Mechanic Certification and by taking enforcement action as needed, we work toward improved compliance results in the future.

Managing Elevating Devices Safety Risks

STAKEHOLDER ENGAGEMENT

Higher fees can be used to promote safer, more responsible behavior. In the elevating devices technology, BCSA noticed a high number of re-assessments for final acceptance inspections, which meant that safety officers' time was being diverted away from other priorities to advance safety within the technology. As an incentive for elevating devices clients to be fully prepared for a final assessment, BCSA consulted on introducing a fee multiplier for each re-assessment. In consideration of client feedback and to allow the industry to be more prepared for these raised expectations, the introduction of the higher fees will be staggered across a number of years, beginning in 2015 for all second and further re-assessments.

In 2014, the Elevating Devices Technology Advisory Committee met three times and established one working group for the following regulatory improvement issue:

- Review of the 2013 edition of the CSA B44 code for adoption in BC.

Working Groups also continued their work in addressing the following technical safety issues:

- emergency operations of elevating devices, and
- safety considerations for private residences' elevating devices.

ONLINE EDUCATION

A pilot online course pertaining to elevating codes and regulations in BC is being developed by BCSA. The course will provide the supplementary education required by one of the apprenticeship pathways in the Elevating Devices Mechanic Certification Program.

MEDIA RELATIONS

BCSA managed 12 media relations actions in 2014 related to elevating devices safety. A listing of all media relations activities can be found in Appendix G.

LICENSING AND CERTIFICATION

BCSA requires that elevators are installed, operated and maintained by qualified and knowledgeable professionals. In 2014, one new contractor licence and 148 certificates of qualification were issued.

TABLE 5-3: NEW ELEVATING DEVICES LICENCES AND CERTIFICATES OF QUALIFICATION ISSUED

TYPE	DOCUMENT	Qty Issued in 2014	Qty Issued in 2013
Licence	Contractor Licence	1	2
Certificate of Qualification	Car Switch & Construction Elevator Operator	96	135
	Personnel Hoist & Construction Elevator Operator	50	28
	Class A Elevator Mechanic	2	0

Exam Results

In addition to obtaining the required experience, individuals must pass the relevant exam (or a series of exams) to obtain a certificate of qualification. These exams help to reinforce the importance of duty holders demonstrating they have appropriate safety knowledge before working in areas where their decisions have the potential to affect the safety of others. These requirements are detailed in the *Safety Standards Act* and regulations. In 2014, there were 378 elevating devices exams taken.

BCSA is including the distribution of exam marks relative to the pass/fail grade to inform discussions and planning around qualifications of workers subject to the *Safety Standards Act*.

TABLE 5-4: ELEVATING DEVICES EXAM RESULT DISTRIBUTION

EXAM	QTY EXAMS	PASS RATE (%)	DISTRIBUTION OF RESULTS
All elevating devices exams taken in 2014	378	94%	
Class A Elevator Mechanic	228	91%	
ED Operator – Car Switch & Construction Elevator	98	98%	
ED Operator – Personnel Hoist & Construction Elevator	52	96%	

In Table 5-4 above, the blue area represents the distribution of the quantity of exams written and marked in 2014 relative to the pass/fail grade (red line). The range of the horizontal axis (x-axis) is from 0% to 100% and is divided equally in 5% increments. The pass/fail grade is 70% for elevating devices exams. A noticeable shift around the pass/fail line can be observed as a result of allowances for errors in examination results.

ENFORCEMENT

The following table summarizes the enforcement actions taken in the Elevating Devices sector in 2014. A listing of all compliance orders and sanctions is included in Appendix C.

TABLE 5-5: ELEVATING DEVICES ENFORCEMENT ACTIONS

	WARNING NOTICES	COMPLIANCE ORDERS	SANCTIONS
Failure to comply with a safety order	0	0	2
Provide records	0	1	0
Tampering or unsafe use of regulated equipment	0	1	0

REGULATORY INSTRUMENTS AND AMENDMENTS

BCSA issues safety orders, directives and information bulletins to stop unsafe activity and provide clarification of regulatory requirements and interpretations. Additional details can be found in Appendix C or at www.safetyauthority.ca.

TABLE 5-6: ELEVATING DEVICES REGULATORY INSTRUMENTS

TYPE	DOC. NO.	TITLE / DESCRIPTION
Safety Order	SO-ED 2014-01	Mandatory Requirements for Removing Elevating Devices from Service
Safety Order	SO-ED 2014-02	Firefighters Key Switch
Directive	D-ED-2014-01	Escalator Skirt/Step Performance Index Field Testing
Directive	D-ED-2014-02	Use of Jumpers
Bulletin	IB-ED 2014-01	Vendor Supplied Machine Room Equipment Guarding
Bulletin	IB-ED 2014-02	Changes to Elevating Booking Procedures and General Contractors and Owner's Checklist
Directive	D-L4 110803 5 Revision 04	Major and Minor Alterations
Directive	D-L4 110303 3 Revision 1	Completion of Non Compliances
Bulletin	B-L4 110803 4 Revision 1	Elevating Devices Internal Cab Modernization
Amendment	N/A	Provisions for Elevating Device Mechanic Certification Program

SAFETY MANAGER'S DISCUSSION

Engagement and responsibility of duty holders is a fundamental building block of the safety system. Duty holders are any person or company who is responsible for compliance because they own, operate or work on regulated products or equipment. Implementing the Elevator Mechanic Certification Program aligns with BCSA's strategic objective to hold individuals who perform regulated work responsible and to ensure they have adequate knowledge and skills.

In December 2014, the Elevating Devices Safety Regulations amendment (in regards to Elevating Devices Mechanic Certification) was approved. This represents a landmark in the history of elevating devices technology and BCSA. BCSA developed the program in close consultation with the elevating industry and requires that elevating device mechanics complete a specified combination of education, training and continuing professional development. Industry-wide standards for training, skills and continuing education will contribute to enhanced safety for both the mechanics who work on elevating devices—including elevators and escalators—and the public who use them. As of March 16, 2015, all mechanics performing work on elevating devices in BC are required to be certified. We continue to engage industry throughout the process, and will work with them to meet the challenge of administering this new program and ensuring there are certified individuals to perform regulated work aligned with their scope of license. We will also continue to review and recognize training programs to ensure the professional progress of elevating devices mechanics.

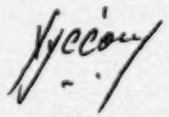
BCSA worked closely with the Association of Professional Engineers and Geoscientists of BC (APEGBC) to create a Professional Practice Guideline. The purpose of these guidelines is to provide APEGBC members and licensees with guidance on the responsibilities of the various professional stakeholders for the design, construction, installation and commissioning of elevating devices in new buildings.

The hydraulic elevators with single bottom cylinders safety order is due to be completed on October 8, 2015. As of January 20, 2015:

- 628 are compliant
- 484 have not submitted compliance plans
- 42 units have said they are compliant but have not provided the proper documentation
- 98 are works in progress
- 7 have submitted compliance plans that are past their date of modification
- 20 units require inspections for cylinder replacement/modification

To ensure full compliance, we will continue to work with contractors and will conduct further one-on-one communication with related owners and property managers.

Educating owners and property managers on their responsibilities related to elevating devices, and how they can better manage their contractors, will also be a continued focus for the program in 2015. We had several meetings with Health Authorities in the Lower Mainland where we exchanged real time information, such as incident reporting, as found conditions and compliance in general. This approach will help all parties take appropriate and timely action towards greater safety outcomes.



Houssam Hamze
Acting Elevating Devices Safety Manager

Understanding Railway Safety Risks

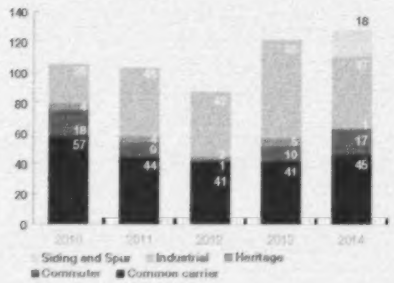
In the Railway Safety Program at BC Safety Authority (BCSA), we regulate railways that operate solely within British Columbia and have a Minister's Certificate issued by the BC Ministry of Transportation and Infrastructure. Provincial Railways are subject to the *British Columbia Railway Act*, *Railway Safety Act* and adopted federal railway safety legislation. In the Railway Safety Program, we regulate five classes of railways: Common Carrier, Heritage, Commuter, Industrial and just recently added, Industrial Sidings and Spurs.

ACCIDENTS AND INCIDENTS

Railway accidents and incidents are reported in accordance with adopted federal regulations. Figure 6-1 summarizes the accidents and incidents reported to BCSA involving railway equipment. Typically, these accidents and incidents are low speed and low risk. Many of the accidents can be attributed to human error and violations to rules and procedures. The Railway Safety Program annually focuses its assessments and audits on employee training and the requirements for railway operators to perform proficiency testing on their railway employees.

Statistics in 2014 indicate a small increase of accidents and incidents over the previous year. As mentioned in last year's report, this may be attributed to better reporting by provincial railways. As well, increased volumes are also directly correlated with an increase in number of provincially regulated railways. Ongoing increases can be expected as the program identifies more industrial sidings and spurs and incorporates them into BCSA's rail safety regime.

FIGURE 6-1: RAILWAY ACCIDENTS AND INCIDENTS 2010-2014

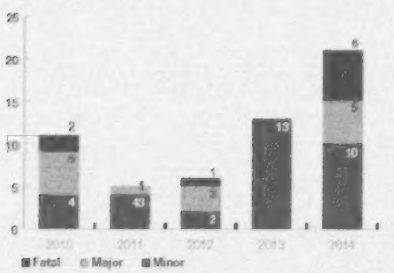


Note: Accidents and Incidents occurring on railway property that are not directly related to a railway's compliance to legislation and performance are excluded. Due to the similar nature in operations and complexity and for consistency in reporting, Industrial Railways and Industrial Siding and Spur Railways are combined.

INJURIES

Provincial railways are required to report injuries that are a result of railway operations to BCSA, including injuries to workers performing train operations or injuries to the public on railway property as a result of train operations.

FIGURE 6-2: RAILWAY INJURIES REPORTED [NOTE 1]



Note 1: BCSA receives its injury reports and descriptions from operators or first responders at the time of, or immediately following, the incident. Injuries may develop after the initial reports were made to BCSA and the long term effects of a resultant injury may not be recorded as part of BCSA's investigation.

TABLE 6-1: FATAL AND MAJOR INJURIES REPORTED IN 2014 [NOTE 1]

Rating	Qty	Description
FATAL	6	Fatalities from railways accidents or incidents
MAJOR	5	Unspecified injuries requiring hospital treatment

Increase in railway fatalities in 2014 is attributed to the inclusion of railway related suicides. No railway fatalities in 2014 can be attributed to unsafe or non-compliant action by a railway operation.

ASSESSMENTS AND AUDITS OF REGULATED WORK

Railway safety officers assess and audit all operating railways as part of regular oversight. Assessments may result with non-compliances where the railway is found to not comply with the applicable acts, regulations, rules and guidelines. Railway operations are also audited against their Safety Management Systems (SMS), which are required for all railways, and the Railway Safety Program issues recommendations as a result of these audits.

FIGURE 6-3:
OPERATING RAILWAYS [NOTE 1]

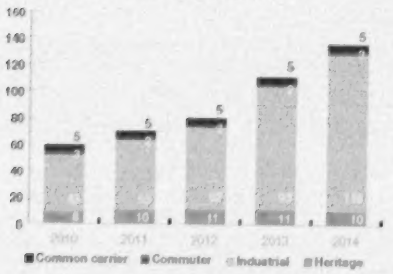


FIGURE 6-4: ASSESSMENTS, NON-COMPLIANCES, RECOMMENDATIONS

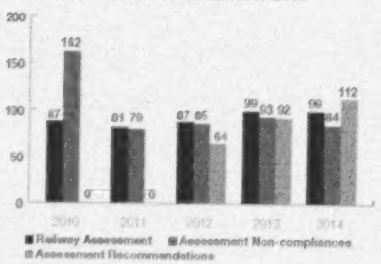


FIGURE 6-5: AUDITS, RECOMMENDATIONS, NON-COMPLIANCES

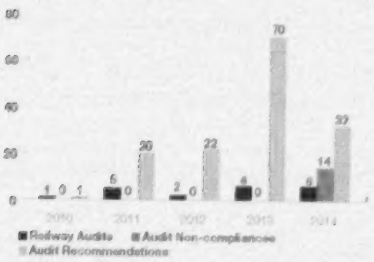
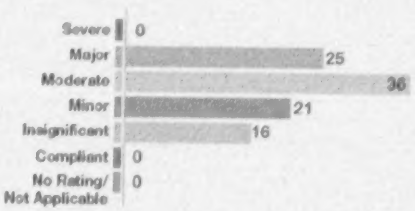


FIGURE 6-6:
AS-FOUND RISK CONDITIONS [NOTE 2]



Note 1: Due to the similar nature in operations and complexity and for consistency in reporting, Industrial Railways and Industrial Siding and Spur Railways are combined.

Note 2: In 2014, the Railway Safety Program assessed railway non-compliance with a newly developed Railway Hazard Map to determine as-found conditions.

The Railway Safety Program's 2014 Work Plan for assessing railway safety activity was determined and directed by findings revealed in non-compliances from assessments, audits, accidents and incidents that occurred in 2013. The Railway Safety Program continued with its comprehensive risk based approach to safety with a continued focus on railway employee training and proficiency testing.

Managing Railway Safety Risks

STAKEHOLDER ENGAGEMENT AND TOWN HALL MEETINGS

In the Railway Safety Program, town hall meetings were held with stakeholders to discuss industry issues, challenges and opportunities. This stakeholder engagement structure is used in the Railway Safety Program in lieu of having a Technology Advisory Committee.

In 2014, 42 provincial railways attended three railway town hall meetings which were held in Kamloops, Prince George and New Westminster. An additional meeting was hosted online, which was new this year. Discussions at these town hall meetings included:

- BCSA 2014 Employee Safety Survey: Workers in Safety Critical Positions
- Statistics
- Annual assessments
- Hazard mapping
- As-found conditions
- Future audit and assessment plans

MEDIA RELATIONS

BCSA managed six media relations actions in 2014 related to railway safety. A listing of all media relations activities can be found in Appendix G.

ONLINE EDUCATION

A pilot online forum was utilized to host one of railway's town hall meetings with clients.

TABLE 6-2: RAILWAY EDUCATION EVENTS CONDUCTED IN 2014

TITLE / TOPIC	Qty of Participants
Railway town hall online forum	4

FIGURE 6-7: RAILWAYS ENFORCEMENT

FIGURE 6-8:
RAILWAYS NOTICE AND ORDER

SAFETY MANAGER'S DISCUSSION

BCSA's Railway Safety Program aims to provide the public, stakeholders and provincial railways with a high level of confidence that railway operations in British Columbia are safe. In 2014, the Railway Safety Program continued its efforts to identify, understand and manage hazardous conditions that may threaten safe railway operations.

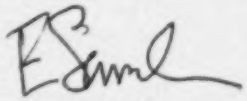
The Safety Management System (SMS) is the foundation for railway safety in Canada and the Railway Safety Program in BC. With the SMS, railways must define safety targets, risk assess their operation, and comply with all applicable rules, regulations and guidelines. Reviewing and learning from assessment and auditing activities that occurred in 2014 were very important to BCSA's understanding of hazardous conditions on our provincial railways.

As reported last year, the Railway Safety Program continues to approach the training and qualification of railway workers as one of the most important aspects of railway safety. It is important to understand that a majority of provincial railways are industrial and not as sophisticated as the national railways that operate across Canada. In 2014, railway safety officers designed and conducted a "Railway Employee Survey" within the industrial railway sector. The survey asked specific questions relating to understanding of railway operating rules and procedures. The survey revealed strengths and weaknesses, and this will now enable the Railway Safety Program at BCSA to target education and enforcement activities at safety critical employees and in areas where they are most needed.

Not unlike any other year, there are always events or innovations that change the way we perceive safety and the actions we take to support it. Since the tragic event at Lac Mégantic in 2013, railway industry has seen considerable change in the regulatory landscape. New rules and regulations have been introduced and many are still in development. Two of the most prominent changes are new rules for the securing of railway equipment and improvements to the SMS regulation.

In 2014, with the rest of the organization, the Railway Safety Program developed and implemented a Railway Hazard Map and started tracking as-found conditions. This new initiative resulted in the logging and rating of 98 non-compliances that were identified through 106 railway assessments and audits. The tracking and rating of these as-found conditions have already started to influence the way we manage safety. For instance, one of the significant challenges of any regulatory regime is to develop consistency between safety officers and their perception of hazard. Working with this new information has already improved how we understand risk and hazards and how we address them. As the program gathers more information and matures, it will further identify opportunities for enhancing safety outcomes.

Finally, the Railway Safety Program will continue to build close ties with railway clients and its stakeholders and will continue to set high expectations for our provincial railways in all aspects of railway safety.

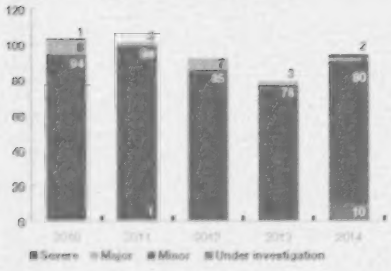


Eric Samuelson
Railways Safety Manager

Understanding Passenger Ropeways Safety Risks

In the Passenger Ropeways Safety Program at BC Safety Authority (BCSA), we are responsible for overseeing the safety of passenger ropeways throughout British Columbia in accordance with the *Safety Standards Act* and the Elevating Devices Safety Regulation. Passenger ropeways include tramways, gondolas, chairlifts, rope tows and passenger conveyors.

FIGURE 7-1:
PR INCIDENT REPORTS 2010-2014



INCIDENTS

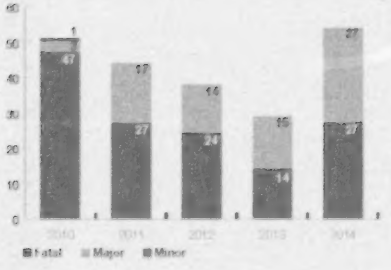
The following summarizes incidents reported to BCSA involving passenger ropeway (PR) equipment.

TABLE 7-1: SEVERE AND MAJOR PR INCIDENTS IN 2014

Rating	Qty	Description
SEVERE	2	Aerial deropements - not retained
MAJOR	1	Aerial deropement - retained
	1	Contact with equipment during maintenance

The types and number of incidents reported in 2014 is generally consistent with previous years. Early in 2014, two SEVERE instances of deropement occurred on aerial ropeways where the passenger carriers fell. A MAJOR instance of deropement was also reported where the haul rope was retained, preventing the carriers from falling. Most MINOR incidents involved passengers falling when loading or unloading from passenger carriers, deropements and equipment failures that required passengers to be evacuated from the carriers. A summary of incidents is included in Appendix A1.

FIGURE 7-2: INJURIES REPORTED 2010-2014 [NOTE 1]



Note 1: BCSA receives its injury reports and descriptions from operators or first responders at the time of, or immediately following, the incident. Injuries may develop after the initial reports were made to BCSA and the long term effects of a resultant injury may not be recorded as part of BCSA's investigation.

INJURIES

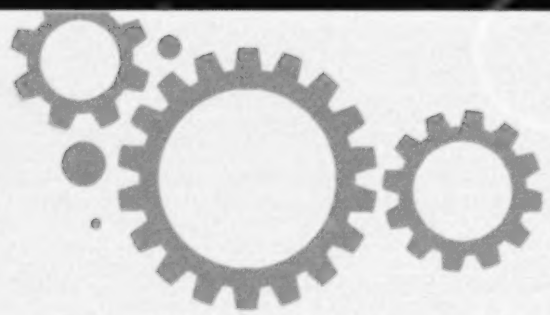
Injuries reported as a result of passenger ropeway incidents in 2014 are summarized below.

TABLE 7-2: MAJOR INJURIES REPORTED IN 2014 [NOTE 1]

Rating	Qty	Description
MAJOR	27	(Possible) Concussions and other head/neck/spine injuries, dislocations and other soft tissue injuries, fractures and other unspecified injuries requiring hospital treatment

More injuries were reported in 2014 than in previous years. Five MAJOR injuries resulted from two aerial deropement incidents and the remaining were associated with misloads and unintended contact with carriers. MINOR injuries reported included pain, strains and bruises from misloads and unintended contact with carriers.

Deropement incidents are reported each year to BCSA. Generally, these incidents do not often result in injuries and damage to the ropeway equipment. Deropement incidents, however, pose a significant risk to passenger safety on aerial ropeways and surface ropeways if the rope and carriers are not retained by the system, as was observed in 2014. Given the consistent number of deropement reports, as well as two SEVERE deropements occurring in 2014, this year's State of Safety Report includes a summary of past deropement reports to BCSA.



DEROPEMENT INCIDENTS (JANUARY 2009 TO JUNE 2014)

British Columbia is home to some of the world's best alpine facilities. Millions of BC residents and tourists frequent these facilities every year to enjoy skiing, snowboarding, mountain biking, hiking and alpine vistas. An integral part of this experience is exciting and safe transportation on passenger ropeways.

Passenger ropeways are some of the safest forms of transportation. Safety and confidence in these systems has been achieved by combining technical advancements in design with a strong safety culture within the industry. Put simply, safety is achieved when passengers remain on their carriers, carriers remain gripped to the cables and the cables remain on the sheaves.

Even though significant advancements have been made in safety, BC experiences a number of incidents every year where the cable of a passenger ropeway departs from the sheaves. Within the passenger ropeways industry, these incidents are called deropements.

All passenger ropeways in BC are required to incorporate a means to retain the cable to the outside of the sheave assemblies should it depart from its normal running position. The means of retention must also allow for free passage of the cable, grips and carriers while the cable is either in or out of the normal position. Testing is required to demonstrate that free passage and safe clearances are maintained during anticipated operating conditions.

Typically, haul rope retention designs have incorporated a series of angle brackets on the outside of sheave assemblies to catch the cable in the event of a deropement. These angle brackets are referred to as cable or rope catchers. To improve the likelihood of the cable catchers to catch and retain the cable, a requirement in BC was added that retention means be located not more than one-half of the sheave diameter vertically from the normal position of the rope and that sensing devices be incorporated to stop the system as soon as possible following a deropement.

In addition to these requirements, ski hill operators take a variety of preventative measures to minimise the likelihood of a deropement event. These measures include: regular inspections of sheave alignment, automated cable tensioning systems, snow plowing/grooming protocols to create tracks to guide skiers in a safe path, and posting signage to instruct passengers to remain on the designated path.

Even with the above advances in requirements for rope catchers and the measures taken to prevent deropements, from 2009 to 2013, on average four deropements are reported annually where the cable is not retained. Deropements present a serious risk to passengers on aerial ropeways, who could fall to the ground and to passengers on surface lifts who could be struck by the falling cable above them. This report summarizes reported deropement incidents occurring from January 1, 2009 to June 30, 2014.

Operating Passenger Ropeways in BC

As discussed above, BCSA is responsible for overseeing the safety of passenger ropeways throughout BC in accordance with the *Safety Standards Act* and the Elevating Devices Safety Regulation. There are generally two types of passenger ropeways operating in BC:

1. Surface ropeways that pull a standing passenger along a surface, and
2. Aerial ropeways where the passenger is completely suspended in a carrier which is attached to a ropeway.

Figure 7.1-1 below shows distribution of the different operating passenger ropeways in BC.

FIGURE 7.1-1
OPERATING PASSENGER ROPEWAYS IN BC

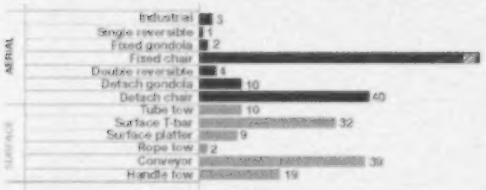
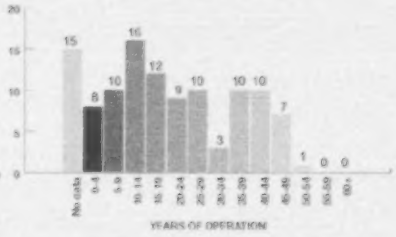


FIGURE 7.1-2
OPERATING AERIAL ROPEWAYS

FIGURE 7.1-3
OPERATING SURFACE ROPEWAYS



There are approximately 237 passenger ropeways operating in BC today, manufactured by approximately 23 different companies and installed at 51 different sites or ski areas. As illustrated in figures 7.1-2 and 7.1-3 above, passenger ropeways operating in BC range in age of installation from less than a year to almost 60 years.

Deropement Incidents January 1,2009 to June 30, 2014

Passenger ropeways are used mainly during the winter months at ski resorts with a few operating during summer months. Most incidents are reported to occur between November and April as illustrated in figure 7.1-4 . Deropement incidents follow the same seasonal pattern with peaks of occurrences happening in January and February as shown in figure 7.1-5.

FIGURE 7.1-4:
PR INCIDENTS BY MONTH AND YEAR

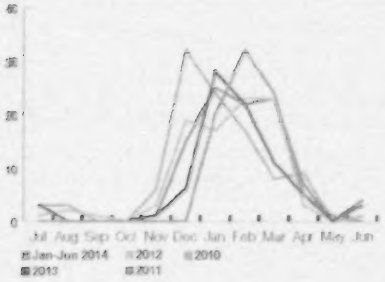
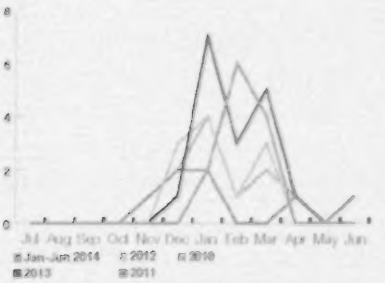


FIGURE 7.1-5: DEROPEMENT INCIDENTS BY MONTH AND YEAR



Figures 7.1-6 through 7.1-8 illustrate relationships between the amount, types of ropeways and types of deropement incidents reported. Figures 7.1-6 and 7.1-7 both summarize deropement incidents by year. Figure 7.1-6 compares the deropements by the type of ropeway on which they occurred (surface or aerial), and figure 7.1-7 further compares the type of deropement (whether or not the haul rope was retained by the rope catching device).

In 2013, six retained and one unretained deropements occurred on the same surface ropeway. Safety officers investigated the multiple incidents and the ropeway design. The investigation identified issues involving the amount of tension in the system and safety officers worked with the owner to modify the design and installation to resolve the issue leading to these occurrences.

On average, approximately nine deropements are reported to occur in BC annually. Every year, almost five deropements are reported to occur where the rope is not retained, resulting in a risk of injury to passengers, workers and nearby persons. Approximately 50% of surface lift deropements and 23% of aerial lift deropements are not retained.

A summary of deropements occurring between January 2009 and June 2014 is included in Table A3-5 (Appendix A3).

FIGURE 7.1-6:
REPORTED DEROPEMENT INCIDENTS

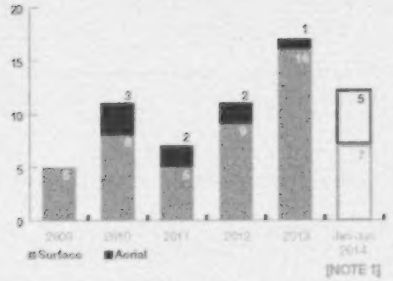


FIGURE 7.1-7: REPORTED DEROPEMENTS BY TYPE, LIFT AND YEAR

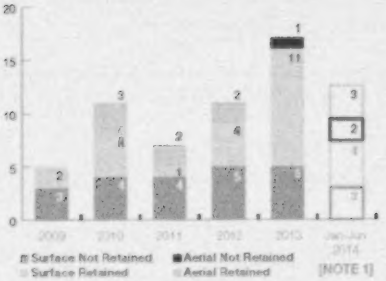
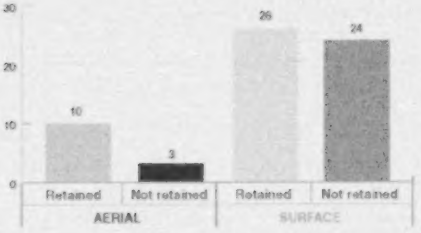


FIGURE 7.1-8: REPORTED DEROPEMENTS BY ROPEWAY TYPE



Note 1: The 2014 columns on Figures 7.1-6 and 7.1-7 represent data over a six month period from January 1, 2014 to June 30, 2014. All other columns represent a 12 month period, from January 1 to December 31.

Deropements and Equipment

Figures 7.1-9 through 7.1-12 summarize deropement incidents relative to the age of the equipment and identified contributing factors. Generally speaking, deropement incidents appear to be fairly evenly distributed throughout the life-cycle of the equipment with the exception of an incident-free period between 3 and 15 years of age.

FIGURE 7.1-9 APPROXIMATE AGE OF AERIAL ROPEWAY WHEN DEROPEMENT OCCURRED

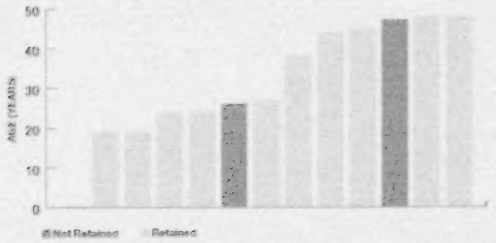
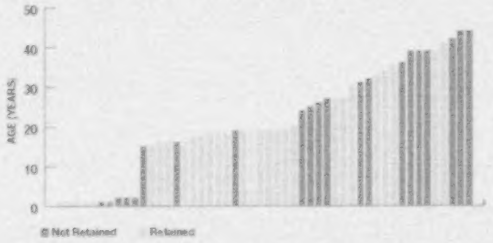


FIGURE 7.1-10 APPROXIMATE AGE OF SURFACE ROPEWAY WHEN DEROPEMENT OCCURRED



Reliability engineering widely uses a concept called the 'bathtub curve' to describe typical failure rates over the life-cycle of a product. At the beginning of a product's life, increased failure rates may be experienced as a result of manufacturing quality errors or installation errors or the lack of familiarity of an operator with the product. Following this phase is a period where a lower failure rate is experienced, often a constant rate that is attributed to random issues. As the product ages and components begin to wear, an increased failure rate can be expected.

Elements of this 'bathtub curve' can be observed when examining the instances of deropement relative to the age of the equipment in figures 7.1-9 through 7.1-12. There is an evident increased deropement rate that is experienced within the first two years of service. There are no deropements reported to have occurred on equipment between 3 and 15 years of age with an increased rate following this period. Equipment installations and operations that are more than 20 years in age experience an increased deropement rate that remains as that equipment continues to age until being retired from service as shown in figure 7.1-11.

Figure 7.1-12 expands upon figure 7.1-11 by further separating the distribution of deropement incidents into the identified cause categories. Each dot indicates a deropement incident. Clusters of incidents can be observed at 0-2 and 15-20 years of age. There is no significant correlation between age and deropement for any cause category after 20 years of equipment age.

FIGURE 7.1-11: DEROPEMENTS AND EQUIPMENT AGE

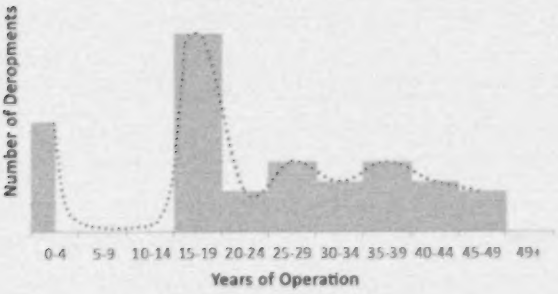
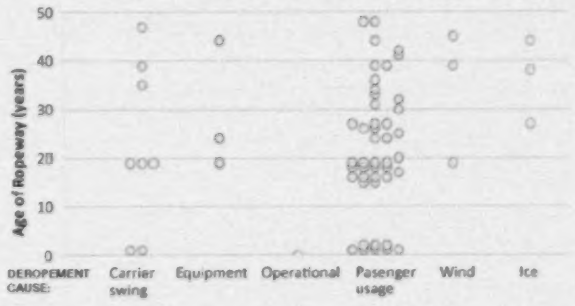


FIGURE 7.1-12: EQUIPMENT AGE AND IDENTIFIED CAUSE CATEGORY



Deropements Resulting in Injuries

Five deropements since 2009 resulted in injuries to passengers. These incidents and injuries are summarized in Table 7.1-1. It is important to note that BCSA receives its injury reports and descriptions from operators or first responders at the time of, or immediately following, the incident. Injuries may develop after the initial reports were made to BCSA and the long term effects of a resultant injury may not be recorded as part of BCSA's investigation.

TABLE 7.1-1: INJURIES RESULTING FROM DEROPEMENT INCIDENTS

ROPEWAY	DEROPEMENT	CARRIER	SUSPECTED CAUSE(S) OF DEROPEMENT	QTY PERSONS INJURED	INJURY DESCRIPTION [NOTE 1]	SUSPECTED CAUSE OF INJURY
Surface	Not retained	T-bar	Passenger may have been skiing out of the tow path; or carrier may have contacted the tower.	1	Broken clavicle, concussion	Contact with cable
Surface	Not retained	T-bar	A passenger fell on the tow path prior to the tower.	1	Abrasion and swollen arm	Contact with cable
Surface	Not retained	T-bar	Passenger may have been riding out of the tow path.	1	Possible bruising	Contact with cable
Surface	Not retained	T-bar	Passengers may have been riding out of the tow path.	2	1 - Fractured shoulder; 1 - Bruises	Contact with cable
Aerial	Not retained	Fixed chair	A swinging chair contacted a tower.	6	4 - Injuries requiring hospital treatment; 2- bruising	Carrier falling to the ground

Note 1: Injury information is provided to BCSA by first responders and/or voluntary reports at the time of investigation. Injury information is provided to give some context relating to impact or scale of the incident.

One out of six (17%) unretained surface deropements and one out of three (33%) unretained aerial deropements resulted with injuries to passengers. Generally speaking, while unretained aerial deropements are much less frequent, they are more likely to result with injuries and those injuries are likely to be more severe.

Summary of Causes

The table below summarizes the main cause and contributing factors identified by BCSA incident investigations.

TABLE 7.1-2: SUMMARY OF FACTORS CONTRIBUTING TO DEROPEMENT INCIDENTS

CAUSE	CONTRIBUTING FACTOR	Qty	DESCRIPTION
Sideways forces or sudden forces applied to the cable	Passenger usage	19	Passenger skiing or snowboarding out of the tow path
		19	Passenger loading or unloading error
		6	Passenger fell on tow path
		1	Passenger swerved
	Excessive carrier swing	3	Swinging carrier during operation
		2	Irregular or uncontrolled carrier retraction
		1	Excessive swing on ropeway start-up
		1	Operator contacted carrier when removing snow
		1	Swinging carrier contacted tower
	Weather	3	High and/or strong winds
Contamination on cable	Weather	3	Ice accumulation
Equipment	Alignment	1	Poor sheave assembly alignment
	Component failure	1	Sheave assembly component failed
	Installation	1	Spring box installed backwards after servicing
Operational error	Lack of experience	1	Although trained, the operator lacked operational experience at the installation location. No other ropeways operating in the same area.

The most frequent contributing factor to deropement incidents relates to how directly passengers interact with the equipment, either along the surface lift tow path, or at the loading/unloading area. The second most common contributing factor relates to carriers swinging during operation. These two factors (passenger interaction with equipment and swinging carriers) combine to have influenced over 84% of all deropements. Appendix A3 further breaks down table 7.1-2 into aerial/surface ropeways and retained/not retained deropements. These two predominant contributing factors account for over 88% of all unretained deropements in BC.

Summary of Deropement Incidents

BC has a thriving passenger ropeway industry that currently operates 126 aerial ropeways and 111 surface lift ropeways. Most incidents, including deropements occur in the winter season between November and April. Every year, passenger ropeways in BC report over five occurrences of a deropement incident. Incidents where the haul rope is not retained by the equipment, and subsequently falls to the ground, can present a considerable risk to passengers or nearby people.

Since 2009, BC has reported a total of 63 deropement incidents with an average of 4.2 deropements on surface lifts and 0.6 deropements on aerial lifts per year. Approximately 50% of surface lift and 23% of aerial lift deropement incidents resulted with the haul rope not being retained.

A total of nine injuries (from five incidents) have been reported since 2009 as a result of deropement incidents where the haul rope was not retained.

Deropement incidents were most frequent on equipment installations of 0-2 years of age or 15-20 years of age. No deropements were reported to have occurred on equipment installations that were between three and 14 years of age.

The vast majority of the deropements are a result of sideways loading on the haul rope. These sideways loads were induced by either direct passenger activity (such as passengers skiing out of the designated path on surface lifts or falling) or by unintended contact from a swinging carrier (chair/T-bar) and other parts of the ropeway equipment.

ASSESSMENTS OF REGULATED WORK

Passenger ropeways safety officers assess new installations as well as operating equipment as part of BCSA's enforcement of the *Safety Standards Act*. These physical assessments provide BCSA and its stakeholders with an understanding of strengths and weaknesses within the safety system and inform priorities for prevention, assessment and audit efforts. During each physical assessment of regulated work safety officers identify whether the work complies with the act, regulations and technical codes as well as identify hazards. These 'as-found' hazards reflect what the safety officers discovered when they initially observed the duty holders' work or equipment, and not the condition following completion of the interaction with the safety officer. A summary of SEVERE and MAJOR hazards found between October 1, 2014 and December 31, 2014 is provided in Appendix B, along with the hazard rating scale.

FIGURE 7-3:
PR PERMITS 2010-2014

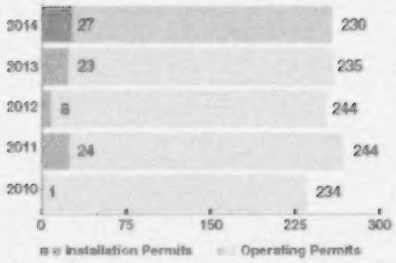


FIGURE 7-4: PR PHYSICAL ASSESSMENT RESULTS IN 2014

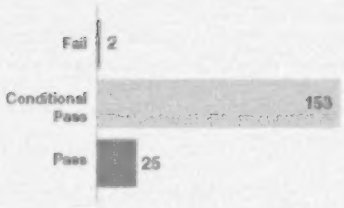
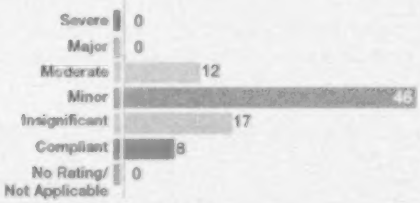


FIGURE 7-5:
HAZARDS RECORDED IN Q4-2014



An increase in installation permits in 2014 is mostly attributed to modifications made to existing passenger ropeways. The number of install permits for new passenger ropeway installations remained the same at five; however only two of those were for above surface passenger ropeways compared with four permits for above-surface (aerial) passenger ropeways in 2013. Of the 180 passenger ropeway physical assessments conducted in 2014, 153 were given a "conditional pass." A conditional pass indicates that non-compliances were found during an inspection but they were not posing major or severe hazards and the contractor was relied upon to file a declaration to state the non-compliances were corrected. For the two physical assessments that were given a status of "failed", non-compliances were found and BCSA safety officers felt it was necessary to return to the site for re-assessment.

Managing Passenger Ropeways Safety Risks

STAKEHOLDER ENGAGEMENT

While the Passenger Ropeways Technology Advisory Committee did not meet in 2014, the two working groups established under this committee each met twice and made significant progress in determining a direction for two important technical safety issues:

- Aging Ropeways: A number of passenger ropeways in BC are approaching the end of their design lifecycle. Before making recommendations on how best to mitigate the risks related to the aging equipment, the working group must first assess the extent of the issue. To this end, the working group drafted a survey regarding maintenance and record-keeping, to be completed by operators of aging ropeways.

- Passenger Ropeways Mechanic Certification: Establishing a certification program for passenger ropeway maintenance personnel would put requirements in place for training, and ensure that individuals performing maintenance on passenger ropeways have the knowledge, skill and ability required to correctly fulfill their duties. The first few meetings of this working group focused on establishing the industry need for such a program, and what a certification program would entail.

Continued work and consultation on these two issues are anticipated for 2015, as well as a meeting of the Passenger Ropeways Technology Advisory Committee.

MEDIA RELATIONS

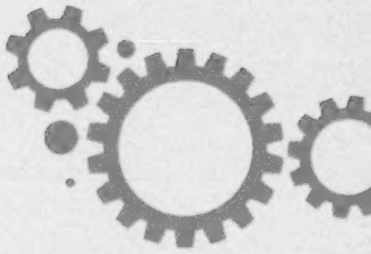
BCSA managed 25 media relations actions in 2014 related to passenger ropeways safety. A listing of all media relations activities can be found in Appendix G.

LICENSING AND CERTIFICATION

BCSA requires that passenger ropeway equipment is installed, operated and maintained by qualified and knowledgeable professionals. In 2014, one licence and two certificates of qualification were issued to individuals that demonstrated the minimum required capabilities to produce safe work.

TABLE 7-3: NEW PASSENGER ROPEWAYS LICENCES AND CERTIFICATES OF QUALIFICATION ISSUED

TYPE	DOCUMENT	Qty Issued in 2014	Qty Issued in 2013
Licence	Contractor Licence	3	2
Certificate of Qualification	PRTC - Fixed Grip	0	2
	PRTHT - Restricted to handle tows	1	1
	PRTB - all unit types except reversibles	1	3



SAFETY MANAGER'S DISCUSSION

Two significant incidents occurred in the first quarter of 2014. The first incident was related to a newly installed eight passenger gondola where a rope grip on an empty passenger cabin became detached from the haul rope due to high winds and the cabin fell to the ground. The passenger cabin was damaged beyond repair, but no persons were injured in the event. The investigation was completed and a full investigation report was published that identified recommendations for the following:

- Improved wind monitoring at the site,
- Improvements to the national passenger ropeway standard to better inform operators of their obligations with respect to operation in high winds, and
- Improved data gathering strategies on new passenger ropeway alignments where no wind data or operational experience exists.

The second significant incident in 2014 was a deropement on an above surface ropeway where the haul rope was not retained and two fully loaded carriers impacted the snow surface seriously injuring four passengers. Another two passengers reported in the media that they received some bruising. This incident was attributed, in part, to a malfunctioning tensioning system, the configuration of the rope catching device, and the tower placements in the system relative to other towers and the loading point. At the time of this publication BCSA is still learning from all of the data gathered in the investigation of this incident and intends to publish a full investigation report in 2015 including recommendations to prevent further occurrences. Both of these significant incidents highlight the need for a certification program for the persons responsible for maintaining and operating these installations to ensure there is a minimum standard of knowledge, skill and ability required to perform this work. BCSA is well underway in consultations with industry to develop a program that achieves this standard and the desired safety outcomes.

The pilot program for our new risk-informed Resource Allocation Program (RAP) was completed in 2014. This pilot initiative allowed us to calibrate the tool in preparation for implementation in the fall of 2014. The tool now generates a risk-informed score for each passenger ropeway operating permit and automatically creates a physical assessment to be performed by a safety officer when an established score threshold is reached and in consideration with other factors according to a safety officer's realm of expertise. This approach will help ensure we are deploying our safety program resources to areas where the safety system gets the most value.

The passenger ropeway industry has been challenged by higher than normal temperatures producing low snow packs at BC ski areas in certain regions in early 2014 and at the start of the 2014-2015 ski season. It is not known what impact this may have on proposed new installations for 2015; however, it is normal to have uncertainty in this regard as most decisions are not made on new construction until near the end of the operating season.

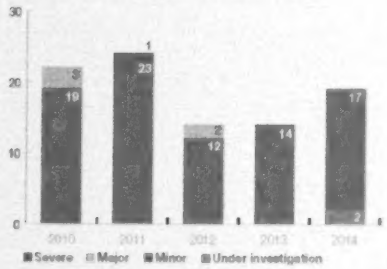
BCSA continues to refine its data gathering strategies to better inform our passenger ropeway safety program of the risks that require mitigation. The development of a passenger ropeway mechanic certification program will be a multi-year process and a strategy for aging passenger ropeways will be continued work for this technology in 2015 to address the risks we continue to learn about from our data collection.

Jason Gill
Passenger Ropeways and Amusement Devices Safety Manager

Understanding Amusement Devices Safety Risks

In the Amusement Devices (AD) Safety Program at BC Safety Authority (BCSA), we are responsible for overseeing the safety of amusement ride installation and operation throughout British Columbia in accordance with the *Safety Standards Act* and the Elevating Devices Safety Regulation. The types of regulated amusement devices range from small waterslides and inflatable play equipment to larger rides such as roller coasters operating at the Pacific National Exhibition.

FIGURE 8-1:
AD INCIDENT REPORTS 2010-2014

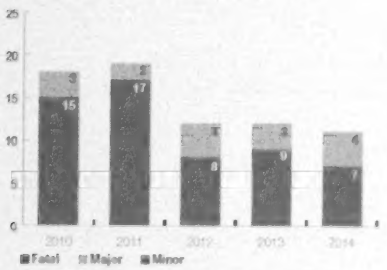


INCIDENTS

The following summarizes incidents reported to BCSA involving regulated amusement devices.

There were no significant changes to the number and type of incidents reported to BCSA in 2014 as compared to previous years. MINOR incidents tended to be slips and falls while entering or exiting amusement rides. A summary of incidents is included in Appendix A1.

FIGURE 8-2: INJURIES REPORTED 2010-2014 [NOTE 1]



Note 1: BCSA receives its injury reports and descriptions from operators or first responders at the time of, or immediately following, the incident. Injuries may develop after the initial reports were made to BCSA and the long term effects of a resultant injury may not be recorded as part of BCSA's investigation.

INJURIES

Injuries reported as a result of amusement device incidents are summarized below.

TABLE 8-1: MAJOR INJURIES REPORTED IN 2014 [NOTE 1]

Rating	Qty	Description
MAJOR	4	(Possible) head injuries or fractures

There were no significant changes to the number and type of injuries resulting from incidents occurring in 2014. Minor injuries were typically bruises, lacerations, pain and discomfort associated with slips and falls on amusement rides.

ASSESSMENTS OF REGULATED WORK

Amusement devices safety officers assess new installations as well as operating equipment as part of BCSA's enforcement of the *Safety Standards Act*. These physical assessments provide BCSA and its stakeholders with an understanding of strengths and weaknesses within the safety system and inform priorities for prevention, assessment and audit efforts. During each physical assessment of regulated work, safety officers identify whether the work complies with the act, regulations and technical codes as well as identify hazards. These 'as-found' hazards reflect what the safety officers discovered when they initially observed the duty holders' work or equipment, and not the condition following completion of the interaction with the safety officer. A summary of SEVERE and MAJOR hazards found between October 1, 2014 and December 31, 2014 is provided in Appendix B, along with the hazard rating scale.

FIGURE 8-3:
AD PERMITS 2010-2014

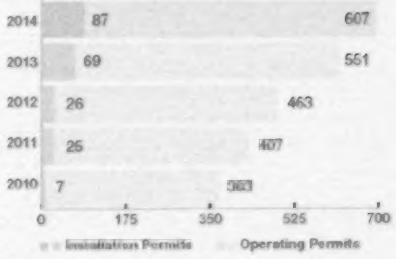


FIGURE 8-4: AD PHYSICAL ASSESSMENT RESULTS IN 2014

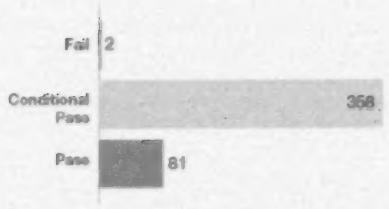
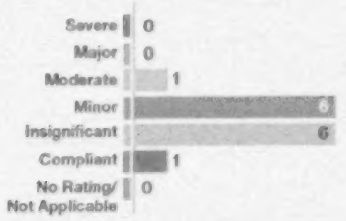


FIGURE 8-5:
HAZARDS RECORDED IN Q4-2014



Volumes for new installation permits remain steady with a slight increase from 2013, which can mostly be attributed to continued registration of inflatable amusement devices such as slides and bouncy castles. Physical assessment numbers have increased partly due to the number of required new installation acceptance assessments and a number of waterslides that had reached a threshold for the time since their last assessment. A low number of recorded hazards in Q4 for amusement rides and devices is due to the fact that assessment activity for this technology is reduced at this time of year.

Managing Amusement Devices Safety Risks

STAKEHOLDER ENGAGEMENT

Stakeholder Engagement established the infrastructure in 2013 for four sub-committees dedicated to four of the major industries within the amusement devices technology: waterslides, ziplines, amusement rides and inflatables. The Waterslides and Ziplines Sub-Committees each met once in 2014 to discuss BCSA regulations, directives and information bulletins, new technology trends, and other industry issues.

MEDIA RELATIONS

BCSA managed seven media relations actions in 2014 related to amusement devices safety. A listing of all media relations activities can be found in Appendix G.

LICENSING AND CERTIFICATION

BCSA requires that amusement devices are installed, operated and maintained by qualified and knowledgeable professionals. In 2014, 24 amusement devices contractor licences were issued.

ENFORCEMENT

The following table summarizes the enforcement actions taken in the Amusement Devices sector in 2014. A listing of all compliance orders and sanctions is included in Appendix C.

TABLE 6-2: AMUSEMENT DEVICES ENFORCEMENT ACTIONS

	WARNING NOTICES	COMPLIANCE ORDERS	SANCTIONS
Expired contractor license	0	1	0

SAFETY MANAGER'S DISCUSSION

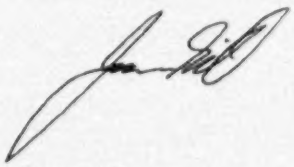
Incident reporting in this technology continued to rise slightly in 2014, which may be attributed to greater awareness on the part of this industry to follow reporting requirements. BCSA continues to remind contractors that it is important to submit incident data so that we may learn from these occurrences and identify strategies to mitigate them.

Preparations will begin in 2015 to develop a risk-informed Resource Allocation Program (RAP) for the amusement device technology in the future. The first step in this process will be to gather data on the performance of the owners/contractors responsible for regulated work being performed on these devices. Safety officers will continue to gather data in the field as assessments are performed and this information will be used to inform our decisions on how we allocate our field resources.

Future state will see RAP fully integrated into our database and automatically assigning assessments to safety officers using this risk-informed process. This will most likely be fully operational in 2016. BC Safety Authority continues to assign these assessments today using a similar manual process but our efficiency will increase as we improve our database tool to automate and manage this process.

The adoption of the new ASTM F2783 Standard Practice for Design, Manufacture, Operation, Maintenance, and Inspection of Amusement Rides and Devices in Canada will take place in 2015. It was anticipated that this would occur in 2014 but a delay in publishing has pushed the timeline further than expected. This new standard is an important step forward for Canada and replaces a national standard that has not been updated since 2000.

Growth in the AD sector remains steady as new devices are always being introduced to provide amusement and entertainment for the public. Unpermitted devices continue to generate an ongoing effort in this technology to bring those operating outside of the safety system into compliance. The AD Safety program will be exploring opportunities to expand our education efforts for operators through online forums and other efficient means of delivery in 2015. Education is a cornerstone of the safety system and we see huge potential in this sector to use this medium to better inform those responsible for managing the safety risks associated with their obligations.



Jason Gill
Passenger Ropeways and Amusement Devices Safety Manager

Alternative Safety Approaches

An Alternative Safety Approach (ASA) enables an owner or primary operator to address the undertaking of particular regulated work or the use of a particular regulated product through an approach alternative to traditional prescriptive requirements but consistent with the safety objectives of the *Safety Standards Act*. An ASA can be of two types: an Equivalent Standard Approach (ESA) or a Safety Management Plan (SMP). An ESA is a limited-scope alternative safety approach that applies to a limited aspect of an installation or operation, while an SMP is a broader-scope alternative safety approach that may include the safety of all regulated product or equipment or regulated work at an entire facility. An ASA proposal must address the specific risks that may be associated with regulated work or products, and must also demonstrate how the alternative approach meets or exceeds the objectives of the *Safety Standards Act*.

The benefit of an ASA is that it allows the proponent to use the most suitable methods for efficient and safe operation of their specific business. In cases where innovation has outpaced the development of standards and/or regulations, industry can integrate new technology and new approaches through an effective safety management system. The safety management system that the operator uses to manage safety outcomes supports the ASA, so regulatory oversight of the ASA includes formal audit and investigation of that safety management system, rather than individual regulatory requirements with traditional inspection processes, which allows for more comprehensive management of safety risks.

ASAs are being developed with owners and operators in the oil and gas, propane, bio-energy and institutional sectors.

UNDERSTANDING ALTERNATIVE SAFETY APPROACHES SAFETY RISKS

The ASA Safety Program at BCSA is responsible for overseeing the acceptance of ASAs for all technologies under the *Safety Standards Act* in accordance with the *Safety Standards Act* and the Alternative Safety Approaches Regulation.

INCIDENTS

No incidents were reported in 2014 in relation to Alternative Safety Approaches.

ASSESSMENTS OF REGULATED WORK

As a performance-based approach to achieving compliance with the *Safety Standards Act*, assessment of that performance is done using standard audit processes consistent with International Standards Organization standard ISO19011—Guidelines for auditing management systems. Audit findings are categorized in a manner similar to "as found" conditions for traditional inspection-based assessments.

FIGURE 9-1:
ALTERNATIVE SAFETY APPROACHES

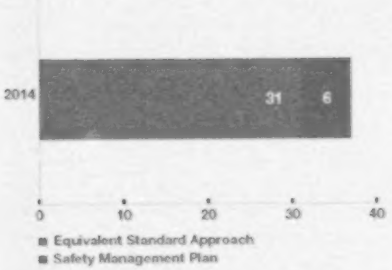


FIGURE 9-2: ASSESSMENT AND AUDIT RESULTS IN 2014

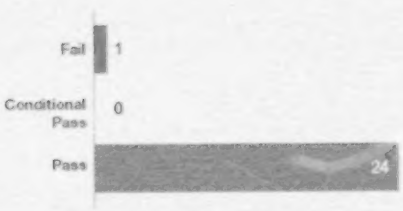


FIGURE 9-3:
HAZARDS RECORDED IN 2014

TABLE 9-1: MAJOR HAZARDS IN 2014

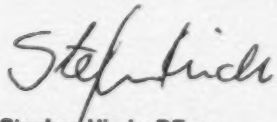
Qty	Description
6	Failure to follow mitigation plan
4	Improper internal audit
3	Improper training
2	Unqualified workers

After acceptance of an ASA, the operator of the facility is audited through a conformance audit that includes site verification. Twenty-five conformance audits were conducted by BCSA in 2014. One SEVERE hazard was identified, which was related to flooding occurring during the audit; the audit was resumed after the imminent safety hazard had been addressed. Fifteen MAJOR hazards were also identified during conformance audits. The largest category, failure to follow risk control plans, involved two different operators without adequate monitoring of boiler or pressure safety devices. At one site, this resulted in a failed audit, and the ASA was suspended until corrective action was completed.

SAFETY MANAGER'S DISCUSSION

There are 37 ASAs that have been accepted for use request alternatives in three major areas of regulation: within the Safety Standards General Regulation (SSGR); within the Power Engineers, Boilers, Pressure Vessels, and Refrigeration Safety Regulation (PEBPVRSR); and within the Electrical Safety Regulation (ESR). The audit process used by BCSA for assessment of compliance focuses on procedures and processes identified in the ASA that may lead to a hazardous installation or operation. The 25 conformance audits performed by BCSA in 2014 found 100 non-conformances. These non-conformances represent improper behaviour on the part of the duty holder, and correction of the behaviour has a greater impact on the safety outcome than simply correcting a non-compliant condition. We have seen significant improvement by duty holders to implement more robust processes to monitor and control their own activities, for example, to improve the processes to determine if the workers are appropriately qualified for the assigned task. One audit resulted in the suspension of the ASA because the major hazards identified included changes to the installation that negated the effectiveness of an essential risk control element. After correction of the installation, and implementation of procedures to prevent recurrence of such changes, operation under the ASA was reinstituted.

ASA, and in particular auditing of the safety management system used by the operator, is proving to be an effective method to meet the safety objectives of the *Safety Standards Act*. In 2015, we will continue to audit ASAs with a focus on the procedures the operator uses to manage their own safety management system. This approach to managing safety is providing the operator with a safety oversight model that provides them with greater flexibility to meet their operational needs, but at the same time, operators are recognizing the value of the model in assisting them to achieve better safety oversight by focusing on the leading behaviours rather than the direct safety outcome.



Stephen Hinde, P.Eng.
Alternative Safety Approaches Safety Manager

Appendix A1 Incident Summaries

TABLE A1-1: ELECTRICAL INCIDENTS

INCIDENT DATE	CITY	INCIDENT RATING	QTY. INJURIES	INJURY DESCRIPTION	INJURY RATING	DAMAGE
16-Jan-2014	Richmond	Severe	1	Burns	Minor	None
5-Feb-2014	Kelowna	Severe	0	NA	NA	Conduit and high voltage cable damaged
14-Apr-2014	Delta	Severe	0	NA	NA	Meter base terminations destroyed
5-May-2014	Whistler	Severe	0	NA	NA	One feeder cable damaged
31-May-2014	Port McNeill	Severe	3	Electrical shock	Minor	RV damaged; two canines required veterinary attention
24-Jul-2014	Shearwater	Severe	1	Burn	Minor	None
5-Sep-2014	Penticton	Severe	1	First degree burns	Minor	One set of finger busses and six main 100A breakers replaced
26-Sep-2014	Abbotsford	Severe	0	NA	NA	Exposed energized cables
9-Feb-2014	Black Creek	Major	0	NA	NA	Two agriculture buildings destroyed
21-Mar-2014	Langley	Major	0	NA	NA	Boiler house damaged, three boilers damaged
23-Mar-2014	Peachland	Major	0	NA	NA	None
29-Apr-2014	Kelowna	Major	0	NA	NA	Fire, smoke, water damage
29-May-2014	Kelowna	Major	0	NA	NA	Fire damage
2-Jun-2014	Mission	Major	0	NA	NA	Fire, smoke, water damage
11-Aug-2014	Kelowna	Major	1	Smoke inhalation	Minor	Fire damage. Air conditioning unit and circulating fan destroyed

Incidents that are UNDER INVESTIGATION are excluded from these listings. Tables are sorted by Incident Rating and Date except where noted.

BC Safety Authority (BCSA) receives its injury reports and descriptions from operators or first responders at the time of, or immediately following, the incident. Injuries may develop after the initial reports were made to BCSA and the long term effects of a resultant injury may not be recorded as part of BCSA's investigation.

Appendix A1

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
An arc flash occurred when an electrician was changing a breaker in an energized panel. The electrician's screwdriver came in contact with live (energized) bus bars when he was attempting to tighten a loose screw inside an electrical switchboard.	Electrical worker was working alone and unsupervised. While replacing a breaker, worker attempted to tighten a loose screw in a live panel without following lockout procedure and was not wearing personal protective equipment.
A high voltage cable and conduit were damaged while drilling for a geotherm installation.	Sign-off documentation for utility locates was not followed through. BC One Call was not involved in the utility locate.
An arc flash incident occurred when a utility technician was installing a meter for a temporary power pole installation.	The technician failed to properly test the phase conductors for grounding prior to installing the meter onto an energized meter base. The contractor who requested the service connection believes that the faulty connection was a result of vandalism.
An arc flash occurred at a multi-family residence. A data contractor was drilling a hole through a suspended slab and came into contact with energized branch feeder cables to the electrical closet. The data contractor was drilling through one of three parallel feeder cables in an electrical closet, shorting out the cable feeder and caused the main 1600A service breaker to open under a short circuit condition. The arc flash was contained within the drilled hole.	Data contractor did not realize that feeder cables were installed in concrete prior to commencement of job. An X-ray of floor or area was not performed. Data contractor was not a qualified individual nor an electrical contractor.
A portable metal dog kennel adjacent to an RV at a camp site became energized. Two occupants of a camp site received electrical shocks while attempting to remove their dogs from the metal kennel. A third person, a camp maintenance employee, also received an electrical shock.	The soil is a sandy loam mottled with bivalve shells making digging very easy. The site is a campground, frequently occupied by tenters who drive support stakes into the ground. The occupants of the RV in this incident use 10" metal and plastic pegs to anchor their portable kennel. It is possible that something driven into the ground or a minor excavation tool from the surface has penetrated the cable and interrupted the neutral and ground. Voltage readings taken on June 5 2014 and later by the electrical contractor indicate an open neutral and ground. There was a partial open-circuit voltage (as high as 19.2 volts) between neutral and ground. A load imposed on the circuit by an RV would result in full line voltage appearing on the neutral and ground conductors prior to where the cable is damaged. If the kennel was set up in contact with the RV, once energized, the fault in the cable would energize the skin of the RV and the kennel would also have been energized at line voltage. The electrical contractor involved in the repair also installed the overhead services to this portion of the campground several years ago but did not install the underground circuitry. Whoever installed the branch circuits did not bury them to the depths required by the BCEC.
A utility employee shorted two phases while connecting a new 400Amp overhead service. A contractor installed a 400 amp 120/240 volt duplex meter base with a parallel 2 1/2 inch rigid mast assembly for connection to a utility triplex drop. Two utility employees attended to make the connection. The utility work order indicated parallel 1/0 triplex was to be installed. The utility employees ran the parallel triplex run. Employee1 (E1) climbed the pole and made the connection to the first triplex run. Employee2 (E2) did a meter check at the service and installed the meter. E1 connected the first phase of the second triplex span, attempted to tie in the second phase but found the conductor to be short. E1 then disconnected the first connection and attempted to connect it to the second phase resulting in a phase-to-phase short.	Phases were not identified on triplex. Utility employees observed twin rigid masts and assumed there were two separate services, not one service with a parallel feeder and common bus. Employees were not familiar with this type of service connection.
An electrician working on an energized meter caused an arc flash resulting in a power disruption.	While removing the circuit breaker screws, the electrician's screw driver slipped and contacted the grounded metal enclosure resulting in an electrical explosion and arc flash.
An electrical hazard at an occuped mobile home park was reported to BC Safety Authority. More than 50 sites with exposed 240V electrical exposed to the public; overhead primary line in contact with tree branches.	Vandalism; electrical wiring and covers were stripped from the switch/meter units while still energized.
A fire occurred at an agricultural site. An electrical failure at the location of the main 200A panel is suspected to have caused the fire.	Incorrect installation. The fire appears to be caused from an electrical failure at the location of the main 200A panel. Indicators pointing to this location are the V-pattern at the main panel, and the lowest point of burn (charring at the floor on the 2x 6 plate) below the panel. The main panel suffered more damage than the other sub-panel (twisted and melted sections). The main panels cover and service guard were off exposing live equipment. The wiring from this panel was done without a permit by a person with no electrical experience. The termination of the 250mcm cable in the distribution section could have stressed connections to failure, either in the buss or the 100A breaker. Barrel lugs were used to reduce the cable to allow termination into a 100A breaker and may have been a point for a poor connection. Because the covers were off, an arcing situation could have ignited the plastic barrel that was in front of the panel, and/or the plywood the panel was mounted on. The fuel to feed the fire would be the plywood sheeting inside the entire dome.
A fire occurred at a commercial premise.	Although the cause of the fire was undetermined, electrical equipment was suspected to be involved.
Unsafe electrical conditions at a recreational premise were reported by a contractor to BCSA.	Unsafe conditions existed because regulated electrical work was found performed and authorized without permission and, from evidence provided, performed by unqualified individuals.
A fire occurred at a commercial premise. Regulated electrical equipment/work is suspected to have caused the fire.	Upon entering unit A, substantial damage was observed in the vicinity of test bench for equipment related to electrical solar equipment. The power panel at bench supplied space heaters located on wall to left of bench, outlet receptacles, and larger loads for inverter. The power distribution was located in unit B and found that feeder and overcurrent protection of 60A was inadequate for load demand in unit A. Upon further review of unit A, it was observed that two power strips plugged into duplex receptacle not dedicated and powered from unit B along with other outlets. The location of one power strip was found directly on test bench behind oscillator and other test equipment and condition almost indiscernible. In addition, another power adapter was plugged into this power strip. From evidence gathered, various test equipment and a solar boost unit appears to have been utilized from this source which is not intended for this purpose. After review of fire pattern, condition of power strip and condition of equipment powered from this unit, it is believed that the power strip is likely origin of this incident.
A fire occurred in the attic space of a commercial premise. Regulated work/equipment was suspected to have caused the fire.	The cause of the fire was determined to be branch wiring conductors. The overcurrent device was in the "on" position prior to the fire occurring. The overcurrent device tripped at some time during the event. Insulators had previously been spraying thermal insulation into the attic space where the fire occurred prior to and during the time the fire occurred.
A fire occurred at a single-family residence.	It is possible that a fault on the triplex cable caused an arc above the roof which ignited the cedar shingles. If the triplex had pre-existing damage to the insulation it is possible that one of the line conductors contacted the neutral conductor causing an electrical arc. This may have been caused by movement of the conductors from the wind, a branch contacting the cable, or deterioration of the cable insulation.
A fire occurred on the upper deck area of a single-family residence. The cause of the fire is suspected to be an incorrectly installed air conditioning unit.	An incorrectly installed AC unit in a window fell on the deck while in operation. The internal damage to the unit by the fan motor seizing or the plastic fan motor blades contacting the hot line tubing from the condenser unit created a high temperature condition for the unit when in contact with the deck and exterior wall of the house started a exterior fire.

Appendix A1 Incident Summaries Continued

TABLE A1-1: ELECTRICAL INCIDENTS

INCIDENT DATE	CITY	INCIDENT RATING	QTY. INJURIES	INJURY DESCRIPTION	INJURY RATING	DAMAGE
1-Sep-2014	Vernon	Major	1	Not specified	Minor	Fire damage
10-Sep-2014	Kelowna	Major	0	NA	NA	Soot, fire damage.
14-Sep-2014	Chilliwack	Major	0	NA	NA	Fire, smoke damage
17-Sep-2014	Quathiaski Cove	Major	0	NA	NA	Fire damage
1-Oct-2014	Kelowna	Major	0	NA	NA	Fire damage
23-Oct-2014	Kelowna	Major	1	Smoke inhalation	Minor	Fire damage. Extension cord, several power bars destroyed.
6-Jan-2014	Winfield	Minor	0	NA	NA	Dust extraction collection bag damaged
9-Jan-2014	Mackenzie	Minor	1	Not specified	Minor	Control and wiring harness damaged.
16-Jan-2014	Salmon Arm	Minor	0	NA	NA	Water, smoke, fire damage
22-Jan-2014	Chilliwack	Minor	0	NA	NA	Fire damage
3-Feb-2014	Kelowna	Minor	0	NA	NA	Fire damage. electronic items related to the remote control destroyed
13-Feb-2014	Port Coquitlam	Minor	0	NA	NA	Heating thermostat outlet box damaged
14-Feb-2014	Sooke	Minor	0	NA	NA	Sailboat, motor boat hull and neck destroyed by fire.
16-Feb-2014	Fort Nelson	Minor	0	NA	NA	Transformer requires replacement
17-Feb-2014	Barrowtown	Minor	0	NA	NA	Smoke damage
25-Feb-2014	Whistler	Minor	0	NA	NA	Fire or smoke/heat damage to sauna components
25 Feb 2014	Kelowna	Minor	0	NA	NA	Components destroyed and damaged.
2-Mar-2014	Courtenay	Minor	0	NA	NA	High bay light fixture destroyed.
13-Mar-2014	Kelowna	Minor	1	Not specified	Minor	Fire damage
13-Mar-2014	Prince George	Minor	0	NA	NA	None

Appendix A1

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
A fire occurred at a single-family residence. Regulated work/equipment is suspected to have caused the fire.	It is suspected that the equipment installed in an unapproved manner created undue stress on the existing service demand, caused overheating issues that caused combustible material to catch fire.
A fire occurred in the basement workshop of a single-family residence.	The cause of the fire was determined to have been a high resistant connection of electrical wire insulation and created a short circuit failure caused by over-tightening of the wire support strap within the outlet box.
A fire occurred at an industrial facility.	The cause of the fire was undetermined; regulated work/equipment is suspected to be involved.
A fire occurred at a single-family residence.	An unguarded incandescent bulb on the wall of a main-floor bedroom closet was left on when the owner/occupant left the building. Bedding or clothing came into contact with an unguarded light bulb on the wall of a bedroom closet, resulting in a fire.
A fire occurred in a detached garage/shop at a single-family residence. The overhead electrical service and panel area received most of fire damage from heat patterns on wall and meter location. Further review indicates heavy heat damage to panel enclosure and exterior door adjacent to panel. The branch circuit panel cover was never installed and lying on floor below panel. This was confirmed with owner and installer. In addition, the branch breaker compartment of panel was totally destroyed and bus bars completely disintegrated. Evidence indicated that fault occurred across main bus bars, indicating large fault occurred. This fault would have created enough heat to cause the panel to ignite combustible material.	Cause of fire was electrical in nature. Unable to confirm cause of electrical fault across panel bus bar that created heating condition ultimately igniting combustibles. Unable to determine if inadvertent contact with bare exposed panel bus was from within panel or something fell onto bus from an external source.
A fire occurred at a commercial premise.	The heater was a dual wattage (2x750W) switchable with a fan blower NOMA portable heater. The heater was connected to power with an extension cord and several power bars. The cord was a light duty 16 gauge cabtire cable and in poor repair. Human error along with poor cord choice and well as power bar usage and then connecting a 1500 watt portable heater caused the extension cord to burn due to being covered by heavy combustible carton
A fire occurred in the dust extraction collection bag at a commercial premise.	A saw blade was installed incorrectly (backwards). When actuated, large wood chips were created and heated up due to the friction of the blade not cutting. The heated particles were drawn into the dust extraction system.
A fire occurred at an industrial facility.	A contract electrician energized the control test panel for trouble shooting and did not turn it off when he left. The wiring harness behind the control was loose. The wiring harness contacted a control that overheated and caused the insulation to melt and catch fire.
A fire occurred at a single-family residence. There was evidence of arc fault damage indicating an electrical failure in the area of origin. Electrical work/equipment is suspected to have caused the fire.	An open splice between NMD (sic) 7 cable and knob and tube wiring had been performed in the past. The splice was without a junction box, or cable connectors. Evidence of wire nuts was found. The splice had been sandwiched between structural building members, namely a 2x4 and a 2x8. An arc fault occurred between the unused bonding conductor and the hot conductor where it was pressed up against the 2x8 structural member by the adjacent 2x4. Arc fault beading on the hot conductor was found to be in direct alignment with point of origin of fire. Once the fire had worked its way through the 2x8 structural member, air from the attic was available and the fire then started. The circuit breaker was found in the tripped position.
A fire occurred at a single-family residence. The cause of the fire was undetermined and there was no evidence to indicate the fire was of electrical origin.	The fire inspector's determined that the area of origin was in the ceiling space of the enclosed front porch. The only wiring in this area was one circuit of knob and tube wiring to feed two ceiling light fixtures, one of which was an original rosette. Newer NMD90 conductors from the service entrance panel passed through the area without splice. The knob and tube wiring was intact except for one neutral conductor which may have been broken in the fire overhaul. All ceramic insulators and tubes were in place and all splices were intact. No alternate sources of ignition were found in the area of origin. No evidence to indicate fire was of electrical origin.
A fire occurred at a single-family residence. An altered remote control battery charger is suspected to have caused the fire.	A remote control battery charger was being used to charge nickel metal hydride (Ni-mh) battery for a hobby toy race car. The charger was altered by adding additional wiring to extend the charger capacity for extra batteries. This caused the charger and battery to over heat which melted their plastic casing. The hot plastic ignited additional cardboard egg trays and papers that where on the kitchen counter.
A fire occurred in the garage at a single-family residence. Regulated work/equipment is suspected to be involved.	The homeowner changed the existing thermostat for the wrong type/rating of programmable thermostat.
A fire occurred at a commercial premise (boat yard). A sailboat located in the boatyard caught fire and spread to an adjacent motor boat.	Undetermined.
A duty holder reported equipment failure. A line fuse was noticed to have being blown.	Transformer had a short in it.
A fire occurred at an industrial premise after a chain-hung electric radiant electric heater core fractured and failed. A piece of the core fell onto wooden pallets and a slow smouldering fire occurred.	A chain hung radiant electric heater core fractured and failed. A 300mm piece of the core fell on to wooden pallets stored underneath and a slow smouldering fire occurred.
A fire occurred in the heater element of a sauna installed at a commercial premise. Regulated work/equipment is suspected to have caused the fire.	The sauna heater was left on overnight, and did not shut off due to damaged capillary tube, and timer failure. The 30 minute spring wound timer was determined to be faulty. The timer internal contacts did not open when timer stopped working after a 5 minute time out cycle. This would in turn keep the circuit energized to the heater controller. The capillary tube bulb end that is normally installed in the sauna room to provide high temperature control method had been cut off. This would not allow the temperature controller to operate correctly and shut off. Since the timer was not functioning correctly, there was no safety system backup in place to have the heater turn off automatically. The fact that the capillary tube bulb was cut off, the only other way the heater would shut off automatically would be by the timer. The failure of the timer was not product failure, but misuse of equipment by pubic. Age of timer and typical use by public by turning the timer to off instead of letting timer time out.
A fire occurred at a multi-family residence. Regulated work/equipment is suspected to have caused the fire.	A poor mechanical connection caused a failure at a recently installed programmable thermostat.
A light fixture failed and caught fire in a commercial premise.	The 347V fixtures ballast likely overheated causing the fire.
A fire occurred at a single-family residence. Although the cause of the fire is undetermined, electrical equipment is suspected to have caused the fire.	The ignition source was located to be at a work bench. Battery charger and battery where left unattended while energized.
An occupant at a multi-family residence reported that the circuit breaker continually tripped while using an appliance.	Incident happened because the circuit inside the apartment was being over loaded by tenant using curling iron and hair dryer at the same time. Because the tenant had a previous problem with a living room outlet tenant was concerned and wanted the electrical to be inspected.

Appendix A1 Incident Summaries Continued

TABLE A1-1: ELECTRICAL INCIDENTS

INCIDENT DATE	CITY	INCIDENT RATING	QTY. INJURIES	INJURY DESCRIPTION	INJURY RATING	DAMAGE
20-Mar-2014	Prince George	Minor	0	NA	NA	Fire, water damage
21-Mar-2014	Langley	Minor	0	NA	NA	Smoke damage; main electrical panel damaged
25-Mar-2014	Langley	Minor	0	NA	NA	10hp-230 V 3phase motor damaged; wiring to 10hp motor damaged; Fire damage to structure
2-Apr-2014	Kelowna	Minor	0	NA	NA	Hedge trees, fence panel, tree, garden bed scorched by fire
10-Apr-2014	Golden	Minor	0	NA	NA	Fire, smoke and water damage
12-Apr-2014	Sorrento	Minor	0	NA	NA	Fire, smoke damage
18-Apr-2014	Campbell River	Minor	0	NA	NA	Transformer inoperable
22-Apr-2014	Courtenay	Minor	1	Electrical shock	Minor	None
24-Apr-2014	Mission	Minor	0	NA	NA	Fire damage to exterior
27-Apr-2014	Mission	Minor	0	NA	NA	Fire damage
29-Apr-2014	Fort St James	Minor	0	NA	NA	Damage to the chipper soft-start
8-May-2014	Kamloops	Minor	0	NA	NA	Fire damage: sign destroyed by fire.
13-May-2014	Lake Errock	Minor	0	NA	NA	Heat, smoke damage
14-May-2014	Mackenzie	Minor	0	NA	NA	Conductors, marrettes damaged
19-May-2014	Shuswap Lake North	Minor	0	NA	NA	Adapter cord and connection cord end damaged from overheating
23-May-2014	Richmond	Minor	0	NA	NA	None
4-Jun-2014	Langford	Minor	0	NA	NA	Baseboard heater damaged.
5-Jun-2014	Mission	Minor	0	NA	NA	Fire, smoke damage
10-Jun-2014	Mackenzie	Minor	0	NA	NA	Conductor insulation damaged; inside of marrette damaged
14-Jun-2014	Kelowna	Minor	0	NA	NA	Fire, smoke damage
25-Jun-2014	Peachland	Minor	1	Smoke inhalation	Minor	Fire, smoke, water damage
25-Jun-2014	Mission	Minor	0	NA	NA	Electrical load centre bus bars and feeder terminations damaged
6-Jul-2014	Kelowna	Minor	0	NA	NA	Fire damage

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
A fire occurred at a multi-family residence. It is suspected that the improper use of fuses at the sub-panel allowed an overloaded circuit to function and caused the fire.	Improper use of fuses at the apartments sub panel allowing an overloaded circuit to continue to function. Eventually the heat build up at the bedroom receptacle being used by the electric heater and medical bed melted the electric heater cord and started the bed on fire.
A fire occurred inside a combination panel. There was a short circuit condition inside of two 30A GE-type THQL breakers. The failure caused a short circuit condition between the two breakers.	Failure of the insulation inside a 30 circuit breaker with a cycling 25 amp load. Insulation of oversized heating elements in hot water heating tank may have contributed to this incident.
A fire occurred at a commercial premise. The cause of the fire is undetermined, electrical equipment may be involved.	Electric motor bearing overheated and ignited oily wood debris.
A fire occurred at a single-family residence. It is suspected that a bad splice on the 12v side of a landscape lighting ballast failed and caused the fire.	The circuit breaker for the circuit in question did not trip. Ballast probably saw the fault as a load that never made a sudden spike or increase, but rather a steady draw, causing an overheating situation.
A fire occurred at a single-family residence.	The inappropriate use of numerous undersized extension cords is suspected to have caused the fire.
A fire occurred at a single-family residence. Although the cause of the fire was undetermined, electrical equipment is suspected to be involved.	No arc fault damage to equipment or conductors was present. Some evidence of moisture corrosion and unmaintained electrical equipment was found, but could not be confirmed as responsible.
A 150KVA, 600V/480V transformer was damaged when a qualified individual was working on the starter that supplied a 30HP motor to a band saw head rig.	The controls for the motor had been configured such that two contactors were used to start it. One of the contactors is reported to have been shorted closed. The qualified individual closed the second contactor and the subsequent current flow resulted in an open fuse. The fuse was replaced, the qualified individual again attempted to start the motor, and a second fuse opened - but not before the transformer windings were burned out. The qualified individual later replaced the transformer and altered the configuration of the starter so that one contactor now controls the motor. The attending contractor was not familiar with a star-delta motor starter arrangement and did not configure the contactors correctly.
An employee received a 120V electrical shock while setting up an amusement ride.	According to the Field Safety Representative the flexible power cord had been supported through the hook of the hoist and had worn through the jacket making live contact with the hook.
A fire occurred at a single-family residence.	Arson suspected, no evidence of electrical cause.
A fire occurred at a multi-family residence.	The cause of the fire was undetermined and there was no evidence to suggest electrical equipment/work contributed to the cause. The fire department investigator suggested smoking materials may be the cause.
A fire occurred at an industrial premise after a motor failed.	The 300 HP soft start failed during start up due to a loose connection on the load side of the starter.
A fire occurred in a neon sign at a commercial premise.	Short circuiting occurred in the high voltage supply to a neon sign letter due to water ingress into the high voltage connection to the sign. Incorrect dry type connectors had been used in a wet location (building exterior) and high voltage tracking occurred.
A fire occurred at a single-family residence.	The receptacle appears to have over heated due to the large 1500 Watt load of the electric barbeque and a loose connection on the line side of the 15A, 120V duplex receptacle. This caused the blades of the attachment cord to become over heated and melted the moulded attachment cord end.
An electrical contractor discovered incorrect splicing of aluminum to copper with copper-only marrettes at a single-family residence.	The circuit that failed was overloaded and was terminated with both approved and not approved marrettes. A few of the approved marrettes were incorrectly sized for the number of conductors and the connections eventually failed.
A fire occurred at an RV site due to the failure of the adapter cord.	The main cause of the adapter cord failure was overloading. The adapter cord did not have internal overcurrent protection. Heat build up due to excessive electrical current on the cord connections over a period of time would have caused tinning, high resistive connections, arcing, pitting, an the eventual break down of the conductive materials in the cord ends. 240 volt loads had been utilized from the 120 volt electrical pedestal connection (air conditioner, and other undermined loads). Voltage drop for the application would be approximately 5%, utilization voltage would have been approximately 114 volts. The reason the feeder cable and related branch wiring did not fail was the direct burial of the underground cables provided a heat sink for the conductor.
Service interruptions occurred in a commercial facility due to a utility power outage.	Utility power outage
An electrical short occurred in a baseboard heater.	Thermostat located in heater shorted when turned off resulting in an electrical short circuit that was contained within the heater
A fire occurred in the attic space of a commercial premise (manufacturing plant). An exterior lighting fixture is suspected to have caused the fire.	Flexible cord was improperly routed from the remote ballast to the fixture mounted to the roof. The ballast was not used in the manner that it was intended and likely fell over or through the soffit material. The weight of the ballast pulling on the flexible cord likely damaged the cable causing it to short circuit the conductors causing the fire. The metal roof having been changed several years previously may have been a factor as the flexible cable may have been partially damaged at that time.
A contractor observed and reported damaged conductors and lights incorrectly wired.	The aluminum to copper splice was terminated with copper-only marrettes. Over time there was a buildup of resistance in the splice and this heated the connection up.
A fire occurred at an institutional premise. Although the cause of the fire was undetermined, electrical is suspected to have caused the fire.	Possible disturbance of electrical supply due to storm or power outage may have caused component(s) of this building fire alarm system to fail and burn.
A fire occurred at a single-family residence.	The cause of the fire was undetermined; Regulated work/equipment is suspected to have been involved. It is suspected than an electrical device overheated and failed.
Electrical arcing damage occurred in a load centre located in one unit of a multi-family residence.	The owner/occupant who altered the branch circuit wiring contacted the wiring to the buses and terminations of the feeder cables in the load centre.
The fire was in an area used for storing bed mattresses, and it seems the space was being occupied by homeless people due to the items on site and the condition of the building. Electrical does not appear to have been involved in the cause of the fire.	The fire was in an area used for storing bed mattresses, and it seems the space was being occupied by homeless people due to the items on site and the condition of the building. Electrical does not appear to have been involved in the cause of the fire.

Appendix A1 Incident Summaries Continued

TABLE A1-1: ELECTRICAL INCIDENTS

INCIDENT DATE	CITY	INCIDENT RATING	QTY. INJURIES	INJURY DESCRIPTION	INJURY RATING	DAMAGE
11-Jul-2014	Harrison Mills	Minor	0	NA	NA	Smoke, heat damage to the distribution panel and receptacle on the RV lot; adapter cord damaged
20-Jul-2014	Courtenay	Minor	0	NA	NA	Thermal damage
23-Jul-2014	Saanich	Minor	0	NA	NA	Partial loss of structure
29-Jul-2014	Delta	Minor	0	NA	NA	Fire, smoke damage
30-Jul-2014	Chilliwack	Minor	0	NA	NA	Fire damage
7-Aug-2014	Chilliwack	Minor	0	NA	NA	Fire damage
11-Aug-2014	Kelowna	Minor	0	NA	NA	Fire damage; portable air compressor destroyed
20-Aug-2014	Langley	Minor	0	NA	NA	Components (distribution panel, breakers, feeder cables) destroyed
27-Aug-2014	Courtenay	Minor	0	NA	NA	Pump house destroyed
11-Sep-2014	Prince George	Minor	0	NA	NA	Fire damage
16-Sep-2014	Vancouver	Minor	0	NA	NA	Damage to receptacle, toaster and wall
26-Sep-2014	Port Coquitlam	Minor	0	NA	NA	None
29-Sep-2014	Fort Nelson	Minor	0	NA	NA	None
15-Oct-2014	Abbotsford	Minor	0	NA	NA	Fire damage

TABLE A1-2: BOILERS, PRESSURE VESSELS AND REFRIGERATION INCIDENTS

INCIDENT DATE	CITY	INCIDENT RATING	QTY. INJURIES	INJURY DESCRIPTION	INJURY RATING	DAMAGE
7-Jan-2014	Chetwynd	Minor	0	NA	NA	None
17-Jan-2014	Vancouver	Minor	0	NA	NA	None
13-Mar-2014	Prince George	Minor	0	NA	NA	Circumferential cracks
1-Jul-2014	Prince George	Minor	0	NA	NA	Eroded, corroded recovery boiler tubes
8-Jul-2014	Courtenay	Minor	0	NA	NA	None
30-Jul-2014	Ucluelet	Minor	0	NA	NA	8" crack at the willet weld

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
The adapter cord over heated and melting the inner conductor insulation and outer jacket of the flexible cord. The adapter cord was found to be over-loaded and an unapproved for electrical device.	The adapter cord is unapproved and appears to have been overheated likely due to over loading of the device caused by power use in the RV. If the adapter was not tested and approved for this use it is possible that it could not sustain the load that it was subjected to. These devices are only designed for a 30 Amp load at 120V. Plugging 50 Amp, 120/240 Volt cords for large RVs with multiple electrical appliances and equipment into these devices creates the potential to over heat the device. There is no way for the occupant of the RV to recognized whether tc much power is being drawn by the unit unless the unit is equipped with some type of monitoring device that will alert the user of the excessive load and/or automatically shed load to prevent the device from being overloaded.
A fire occurred at the rear of a detached single-family residence.	The surface mount electrical disconnect has been identified as the point of ignition in this incident. Likely contributing factors are: - work performed by unqualified individual (Owner). - undersized branch circuit conductors contributing to exceeded terminal temperature rating.
A fire occurred in a stable on private property housing live stock.	Undetermined.
A fire started in the 240V 3-phase, 3-wire meter base at a commercial premise.	Unknown equipment failure in the electrical meter base or meter.
A fire occurred at a multi-family residence.	The cause of this fire was the failure of an unapproved power bar.
A fire occurred in an attached garage of a single-family residence.	A failure of an extension cord is suspected to have caused the fire.
A fire occurred in the work yard of a commercial manufacturing facility. The cause of the fire is suspected to be a faulty connection point of an extension cord used to supply power to a portable air compressor.	The cause was determined to be an electrical extension cord failure creating a high temperature short circuit. The fire was aggravated with the high level of dry saw dust that surrounded the cord.
A fire occurred in the warehouse area of a commercial premise.	Overheated breakers were detected during an earlier preventive maintenance infrared scan by the building management company for this building. It was reported that the damaged panel was due for replacement.
A fire occurred in the pump house at an agricultural site.	Although the cause of the fire was undetermined, electrical equipment/work is suspected to be involved.
A fire occurred in a detached garage at a single-family residence. The cause of the fire was undetermined; there was no evidence of an electrical ignition source or electrical failure.	The fire started on the right side of the garage where a shelving unit was located. There was a container of solvent and a small propane tank on the shelves. There was no electrical ignition source near the origin. The pellet stove in the garage was not in use. There was a BBQ and 20 Lb propane tank outside the garage behind the shelving unit but these were older and not in use at the time of the fire. The owner's testimony suggests the tank was empty. The tank was not connected to the BBQ. The char damage to the inside structure would indicate the fire started inside the garage, not outside. The cause of this fire is undetermined due to the lack of evidence.
A student was using a toaster and observed smoke and arcing at the receptacle.	Deteriorated receptacle
A fire occurred at a single-family residence. Steel wool had made contact between the metal outlet box and garburator outlet supply conductors.	An outlet cover was not installed on the outlet box to prevent foreign objects from entering the outlet box.
An industrial facility experienced a "power bump" that caused the production equipment to shut down. The 25kV breaker opened in the substation.	Wire was found unattached to fuse holder in the power line system.
A fire occurred in a detached shop adjacent to a single-family residence.	Due to the extensive fire damage to the electrical equipment and appliances, the cause of the fire was undetermined. Electrical work/equipment is suspected to be involved.

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
An overpressure incident on a process compressor occurred, causing the pressure vessels and piping to exceed their maximum allowable working pressure.	It is possible that high pressure gas passing through a leaking or partially open valve that connects the high pressure train to the low pressure inlet caused the over-pressure condition to occur.
During a routine shift inspection, an employee (shift engineer) discovered that a retaining bolt disengaged from the man-way door yoke on the oil separator of an ammonia screw compressor.	Pressure cycles, and transmitted compressor vibration, resulted in gradual loss of bolt torque and then movement of the bolt in the slotted yoke, until the bolt slipped out of the yoke.
An employee reported a leak in the tube wall of #5 recovery boiler. The tube leak occurred while the boiler was not in operation. The boiler had just undergone a "chill and blow" to remove surface contamination and the leak was detected while the boiler was being fired on gas.	Not recorded.
An emergency shut down procedure was employed for the #1 Recovery Boiler when the shift engineer suspected a steam tube leak and smelt-water reaction had occurred. The leaks were caused by erosion and corrosion of the exterior of the tubes and the lower crotch plate of the primary air port.	The leaks were caused by erosion and corrosion of the exterior of the tubes and the lower crotch plate of the primary air port.
Emergency services responded to a fire and ammonia alarm at an industrial facility.	Defrost line to ice cream room cooler isolation valve (#144 plant drawing) failed, and relief valve in same line also liftec / failed.
An ammonia leak occurred at an industrial facility. Approximately 30 to 50lbs ammonia refrigerant was released to atmosphere.	Plate freezer elements were moved using hydraulics with no fish to freeze between the plates. Excessive forces on the plate elements caused an approximate 6" crack at the fillet weld along the plate edge. As a result ammonia refrigerant was released intc the atmosphere. The hydraulics are operated manually and have no limit switches. Personnel operating the equipment were given instructions that were not clear enough or misunderstood. The plate freezers are designed to have fish in between them when being operated into the freezing position.

Appendix A1 Incident Summaries Continued

TABLE A1-2: BOILERS, PRESSURE VESSELS AND REFRIGERATION INCIDENTS

INCIDENT DATE	CITY	INCIDENT RATING	QTY. INJURIES	INJURY DESCRIPTION	INJURY RATING	DAMAGE
12-Aug-2014	Abbotsford	Minor	0	NA	NA	More than 25 tubes were observed to be leaking at the steam drum and running along the inner furnace wall. Boiler was put out of service until completion of NDE.
22-Aug-2014	Mission	Minor	0	NA	NA	None
22-Aug-2014	Invermere	Minor	1	Ammonia exposure	Major	Oil contamination, oil loss
1-Oct-2014	Prince George	Minor	0	NA	NA	Two tubes damaged
6-Oct-2014	Winfield	Minor	0	NA	NA	None
6-Oct-2014	Duncan	Minor	3	Ammonia exposure; sent to hospital	Major	None

TABLE A1-3: GAS INCIDENTS

INCIDENT DATE	CITY	INCIDENT RATING	QTY. INJURIES	INJURY DESCRIPTION	INJURY RATING	DAMAGE
27-May-2014	Nelson	Severe	0	NA	NA	Pipe nipple requires replacement.
12-Jun-2014	Coldstream	Severe	0	NA	NA	Fire, water damage
27-Oct-2014	Kelowna	Severe	0	NA	NA	Duct work damaged, electrical wire damaged
22-Nov-2014	Revelstoke	Severe	0	NA	NA	Boiler damaged
9-Jan-2014	Chilliwack	Major	1	Lacerations, bruises, damage to eye	Minor	Gas fireplace damaged beyond repair
23-Jan-2014	Coquitlam	Major	0	NA	NA	Heat, water damage
31-Jan-2014	New Westminster	Major	0	NA	NA	None
16-Mar-2014	Enderby	Major	1	CO exposure	Major	None
31-Mar-2014	Abbotsford	Major	0	NA	NA	Water, smoke damage; appliance destroyed
6-May-2014	Abbotsford	Major	1	Burns to face and neck	Minor	None
9-Jul-2014	Vernon	Major	0	NA	NA	High pressure underground gas line damaged

Appendix A1

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
The chief engineer reported that there was no water in the gauge glass. Boiler was shut down due to an operator observing a low water event.	Initial investigation by COE showed that the LWFCO failed to open on low water level. This fact combined with the fact that the Shift Engineer - SE was pre-occupied with another machine in the boiler room led to a period of approx. 2 1/2 hours where the water level was not properly monitored. Actions of the Shift Engineer were correct upon discovery of the Low Water Level (LWL) up to the point where the Shift Engineer added water to the boiler. LWL was discovered by the SE as there was no alarm sounded when the water level dropped to an unsafe level.
An ammonia leak occurred at an industrial premise. The safety relief valve on the condenser unit was activated.	While starting the plant after electrical power failure, the operator forgot to start the condenser circulating pump which should be started before starting the compressor unit. In this case, the compressor was started without condenser cooling and, as a result, ammonia gas temperature started rising, raising the gas pressure in the system. The gas pressure rose more than the safety valve setting, activating the safety valve and thus releasing the ammonia to atmosphere. As well, the high pressure safety cut off on the compressor did not active. High pressure cut off was supposed to activate and shut off the compressor unit in case of high pressure sensing in the system.
An ammonia alarm sounded at a recreational facility. While in the process of adding oil to a compressor, an operator was sprayed in the abdomen with oil from the compressor. Upon smelling ammonia, the operator immediately left the area and activated the ventilation system on his way out. The operator left the valve to the compressor open and it continued to spray out the remaining oil. The compressor was off but some ammonia escaped into the room.	The operator thought he had turned the valve off before he proceeded to remove the connecting oil hose; he had not. In fact, he indicated that the direction he turned the valve caused it to become more open (wider).
A boiler was removed from service to complete a thermal shed (chill and blow) procedure to remove deposits from the upper roof and walls of the furnace after abnormal buildup on the boiler's upper sections were identified. After the boiler was taken down, material began falling off the tubes and roof, and damaged two recovery boiler screen tubes.	Operating conditions of the boiler contribute to deposits accumulating on the boiler surfaces which when released caused damage to the boiler tubes.
An ammonia leak occurred at an industrial premise. In the machinery room, the nylon #4 compressor mechanical seal failed and leaked ammonia into the room.	The deterioration over time in normal operating conditions, Nylon #4 Compressor Mechanical seal failed.
Approximately 300lbs of refrigerant was released into the atmosphere at a recreational premise. The high side float was not functioning correctly and stuck in the closed position which caused two high pressure excursions.	It should be noted that the glycol cooling system for the compressors was functioning at the time of the pressure excursions.

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
A gas leak occurred on a barbecue box in a unit at a multi-family residence. An attempt to tighten the fitting resulted in shearing the pipe nipple at the tee inside the exterior wall.	The wood structure is believed to be shrinking. There could be 1/2" per floor due to standard construction for buildings with concrete floors poured on plywood requires 4 plates per floor that may compress up to 1/8" per plate times 4 plates would amount to 1/2"per floors times 4 floors (in this instance) would be 2" of vertical building shrinkage and no steel gas piping shrinkage. Gas lines are breaking at the change of direction from vertical to horizontal at the barbecue boxes.
A gas leak occurred at a single-family residence.	A lightning strike in the area caused the gas lines in a home to become energized. The electrical energy transferred into the gas lines in the home and ruptured a corrugated stainless steel tubing line in the home.
A fire occurred at an industrial premise after an air intake fan failed.	Lack of maintenance; No interlock between air supply and gas burner; Poor house keeping.
Occupants at a single-family residence called emergency services after the carbon monoxide (CO) alarm sounded. A wall-hung boiler was not operating properly and created high levels of CO.	The boiler was rated and certified for use with both natural gas or propane gas. There is no conversion kit required to change fuel type. The original instruction manual for the boiler appears to have incomplete fuel conversion procedure instructions. It is likely that incorrect fuel conversion and burner set-up caused the boiler to create high concentrations of carbon monoxide. The boiler has a rated input of 225,000BTUH and does not require a Class A gas fitter to perform commissioning or fuel conversion. The type of training received for Class B gas fitters may not be adequate to ensure safe set up of this type of fuel system. The gas fitter did not follow the boiler manufacturer's venting type or vent tightness testing instructions. The gas fitter did not secure the vent transition near the boiler flue collar connection, which allowed the vent to be come disconnected from the boiler.
An explosion occurred in the fire box of a gas fireplace at a multi family residence.	A heating/HVAC company shut off gas supply due to a faulty safety valve. The occupant continued to use the gas fireplace (bypassed safety measures). When the occupant tried to light the gas fireplace, the buildup of gases in the firebox exploded and caused the glass to shatter.
A fire occurred at a multi-family residence that was under construction.	An untrained worker attempted to disconnect two 100 lb propane cylinders from a construction heater. The worker did not shut off heater before attempting to disconnect propane cylinders. The worker closed the valve on the first cylinder, then closed what he thought was the shut off for the second tank. The worker closed the dust cap for the fast fill valve, and then unscrewed the hose from the cylinder. This allowed propane to vent out through the valve.
A meter was observed dangling in mid-air on the outside of a building under demolition.	A general contractor shut off gas and cut line without the assistance of a qualified gas contractor, therefore did not have the education and knowledge required to do this job safely.
Emergency services responded to a carbon monoxide (CO) alarm at a single-family residence. A furnace spilled CO into the residence.	An old furnace spilled CO into a home.
A fire occurred at a multi-family residence. Regulated work/equipment is suspected to have caused the fire.	The homeowner had been using the decorative fireplace to heat the living space. The fire scene evidence indicates that the fire started in the area around the gas fireplace. The fire department believes that pyrolysis is the probable cause of the fire. There was a brass spring valve that appears to have allowed natural gas to leak out of the valve and add to the fire.
A flash-over occurred when a LNG truck driver attempted to fill the diesel tank. The driver removed the diesel filler cap and inserted the filler nozzle. Diesel vapour escaped from the opening and ignited.	Suspected ignition source is static electrical charge. The filler hose was unapproved and without a grounding wire.
A construction crew hit and damaged an unidentified stub on a high pressure gas main.	The construction crew was sloping ditch. They had exposed the main gas line by hand, the excavator operator was sloping the ditch over the gas line and hit a unidentified stub on the gas main. The trench side sloping area over the gas line was not exposed by hand prior to digging with excavator.

Appendix A1 Incident Summaries Continued

TABLE A1-3: GAS INCIDENTS

INCIDENT DATE	CITY	INCIDENT RATING	QTY. INJURIES	INJURY DESCRIPTION	INJURY RATING	DAMAGE
7-Sep-2014	Pitt Meadows	Major	0	NA	NA	Fire damage
17-Sep-2014	French Creek	Major	1	Possible CO exposure, medical distress	Major	None
16-Nov-2014	Abbotsford	Major	2	CO exposure - sent to hospital	Major	Corroded components
17-Nov-2014	Langley	Major	2	Burns	Minor	Water damage in the boiler room and hallway
29-Nov-2014	Winfield	Major	3	CO exposure - sent to hospital	Major	
30-Nov-2014	Surrey	Major	15	CO exposure - sent to hospital	Major	None
12-Jan-2014	Surrey	Minor	0	NA	NA	Venting connection separated.
28-Jan-2014	Delta	Minor	0	NA	NA	Corroded venting on roof-top units.
17 Feb 2014	Vernon	Minor	0	NA	NA	None
14-Mar-2014	Kamloops	Minor	0	NA	NA	Building, vehicles and ATVs destroyed.
19 Mar 2014	Kelowna	Minor	0	NA	NA	Water damage
26-Mar-2014	Victoria	Minor	0	NA	NA	Fire, heat, structural damage.
6-Apr-2014	Delta	Minor	0	NA	NA	3/4" gas line damaged
11-Apr-2014	Squamish	Minor	0	NA	NA	None
10-Jun-2014	Squamish	Minor	0	NA	NA	None
28-Jun-2014	Mission	Minor	0	NA	NA	Gas line damaged
13-Jul-2014	Aldergrove	Minor	0	NA	NA	Soffit material damaged
13-Jul-2014	Vernon	Minor	0	NA	NA	Appliance (barbecue) and gas hose damaged
11-Aug-2014	Courtenay	Minor	0	NA	NA	Water heater damaged
10-Sep-2014	Saltspring Island	Minor	2	Possible CO exposure	Major	None
12-Oct-2014	Maple Ridge	Minor	0	NA	NA	None
31-Oct-2014	Victoria	Minor	0	NA	NA	Fire damage
1-Nov-2014	Quadra Island	Minor	1	Singed eyebrows, burn	Minor	None
25-Nov-2014	Langley	Minor	0	NA	NA	Underground gas line damaged

Appendix A1

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
A fire occurred at a single-family residence. The gas meter, damaged by fire, fed gas into the existing fire.	The cause of the fire could not be determined but regulated work/equipment may be involved. It was observed that excessive material was being stored around gas meter.
The fire department responded to a carbon monoxide alarm at multi-family residence.	A cracked or plugged heat exchanger caused a furnace to produce excessive carbon monoxide. A missing filter door allowed combustion products to be circulated through the living space.
Emergency services responded to a carbon monoxide alarm at a single-family residence.	The top rain cap had corroded to the point that the top lid of the rain cap collapsed on top of the vent stack and blocked all combustion products from escaping. This condition caused the flue products to back into the combustion chamber leading to incomplete combustion and the generation of carbon monoxide, which then spilled into the residence.
A gas leak and fire occurred at a multi-family residence.	A gas fitter was working on the removal of two boilers from the existing boiler room. When he disconnected the gas piping from the first boiler, he screwed apart the two-piece shut off valve, causing an uncontrolled gas leak that filled the boiler room with natural gas. The escaping gas found an ignition source from the boiler room (possible from existing gas appliances), causing a fire ball.
Emergency services responded to a carbon monoxide alarm at a single-family residence.	The seal around the fireplace glass allowed carbon monoxide to leak into the basement of the house. The gas fitter found the screws holding the glass in place to be loose and the seal was not properly in place.
The fire department responded to an emergency call and observed elevated carbon monoxide levels in a single-family residence.	A high-efficiency condensing boiler was recently installed. The venting from the new boiler was installed incorrectly, permitting the combustion products to return into the boiler/water heater location in the basement.
A fire department responded to a carbon monoxide alarm.	A replacement Weil McLain Gold series boiler was installed several years ago without a permit. The boiler is side vented (Category III) with B type vent. The venting material should be the approved pressure type vent ('SafeT Vent') The B vent was pressed into the B vent 90 and held together with foil tape. The vent connection had separated allowing the positive pressure vent gases to enter the boiler space and migrate into the residence.
A gas odour was reported at a recreational premise.	The proximity of the units allowed for some flue gases to enter the outdoor air supply to the building. The burners were out of adjustment creating odor in the flue gases. It is also possible that atmospheric conditions kept the flue gases nearer to the roof line.
A gas contractor reported that 15 fireplace vents were dislocated from the fireplaces' flue outlets at a multi-family residence.	Incorrectly installed fireplace vents became dislodged from fireplace flue outlets by roofers during re-roofing of the building.
A fire occurred at a single-family residence. Regulated work/equipment is suspected to be involved.	A utility technician observed that the regulator at the meter appeared to be tampered with. The plastic cover for the adjustment screw and the screw itself were both missing.
The water heater's heat exchanger failed and allowed city water to enter the exhaust system, air intake and gas piping system.	Design flaw.
A fire occurred in an indirect make-up air unit at a commercial premise. Although the cause of the fire was undetermined, regulated work/equipment is suspected to be involved.	Heat exchanger may have been plugged resulting in excessive temperatures in the wind box igniting combustible material located on the outer surface.
A gas leak occurred at a single-family residence.	A resident was using a sawsall (sic) to cut through exterior wood at the rear of the house. He cut through the 3/4" steel gas line feeding a decommissioned pool boiler. He was not aware that the gas line was in the soffit space.
Approximately five to ten litres of propane was released at a commercial premise.	A general contractor was in the process of removing the concrete island that previously held an auto propane fuelling dispenser. The general contractor impacted (pushed) the piping in the island during the removal process, creating a compromise at a transition plate from the underground to the globe valves located in the service cover. This led to a leak of approximately five to ten litres of propane. The general contactor did not confirm the underground piping system feeding a auto fueling dispenser was purged of liquid propane prior to removing the surrounding concrete island.
A fire occurred at a commercial premise. Regulated equipment/work was suspected to be involved.	The restaurant owner had left the burners to a commercial grill on high by mistake, thinking they were left off. This likely ignited residual grease surrounding the unit.
A gas leak occurred at an institutional facility.	An electric arc from the clothes dryer to the gas piping supply line burned a hole in the gas line and allowed gas to escape.
After turning on a fireplace on a hot summer day, the unvented vinyl soffit material installed above the fireplace direct vent termination drooped down past the vent termination.	The excessive heat caused from a combination of ambient temperature and the fireplace's flue gas caused the vinyl soffit material to melt.
A fire occurred at a single-family residence.	Although the cause of the fire was undetermined, regulated equipment/work was suspected to be involved.
A fire occurred at the water heater's vent termination at a single-family residence.	It could not be determined if the fire was caused by equipment failure or lack of maintenance.
Occupants at a multi-family residence felt dizziness and nausea following the installation and use of a natural gas range. The range was installed by the owner (unqualified individual) and converted to propane by the occupant (also unqualified).	New gas range had been installed with a copper connector. The connector had been crimped over during removal or installation making proper testing of the appliance impossible. The occupant that one of the propane orifices for one of the top burners was lost during the conversion and the natural gas orifice left in. Two other gas appliances were noted in the suite. An on-demand HWT located in the mud room and a central furnace which was not in operation at the time. Both units were checked including discharge air from the furnace, carbon monoxide was not observed. No record of permit listed for these appliances.
An employee was filling a 20lb propane cylinder. When complete, she turned off the fill value and disconnected the fill valve, the fill valve did not shut off 100% and allowed liquid propene to spill.	The station manager described the leak as minor and the cause was a worn out handle on the fill valve allowing the flip handle to be closed incorrectly.
A fire occurred at a multi-family residence.	Combustible material was stored near a free-standing fireplace and caught fire.
A gas range was installed at a single-family residence. When attempting to light the main burner, a flame blew through the site glass hole (which was missing the glass).	An unqualified person attempted to light the range and site glass was not in place.
An excavating contractor damaged the underground gas service with a truck, causing a gas leak.	The excavating contractor did not wait for the utility to disconnect the gas service before demolition.

Appendix A1 Incident Summaries Continued

TABLE A1-3: GAS INCIDENTS

INCIDENT DATE	CITY	INCIDENT RATING	QTY. INJURIES	INJURY DESCRIPTION	INJURY RATING	DAMAGE
26-Nov-2014	North Vancouver	Minor	6	CO exposure - sent to hospital	Major	None
27-Nov-2014	Vancouver	Minor	0	NA	NA	Collapsed vent
2-Dec-2014	Surrey	Minor	0	NA	NA	None
4-Dec-2014	Surrey	Minor	0	NA	NA	None
11-Dec-2014	Ladysmith	Minor	0	NA	NA	Furnace damaged
12-Dec-2014	Surrey	Minor	0	NA	NA	None
16 Dec 2014	Victoria	Minor	0	NA	NA	Polypropylene venting material damaged

TABLE A1-4: ELEVATING DEVICES INCIDENTS

INCIDENT DATE	CITY	INCIDENT RATING	QTY. INJURIES	INJURY DESCRIPTION	INJURY RATING	DAMAGE
29-Jan-2014	Victoria	Severe	1	Aggravated existing injury and/or' back trauma'	Minor	None
8-Feb-2014	Victoria	Severe	0	NA	NA	None
10-Apr-2014	Chemainus	Severe	0	NA	NA	TBD
15-Nov-2014	Surrey	Severe	1	Pain, swollen ankle	Minor	None
8-Jan-2014	Vancouver	Major	1	Pain, Elbow injury	Minor	None
13-Jan-2014	Surrey	Major	1	"Skin peeling with blood blisters"	Minor	None
12-May-2014	Victoria	Major	1	Broken leg, lacerations	Major	None
6-Jun-2014	Vancouver	Major	1	Fractured tibia; soreness	Major	None
10-Dec-2014	Victoria	Major	1	Lacerations, bruises	Minor	None
9-Jan-2014	New Westminster	Minor	1	(No description)	Minor	Unknown
20-Jan-2014	Prince George	Minor	0	NA	NA	None
31-Jan-2014	Vancouver	Minor	1	Not specified	Minor	None
19-Feb-2014	White Rock	Minor	1	Pain	Minor	None
5-Mar-2014	Victoria	Minor	1	Pain	Minor	None
6-Mar-2014	Vancouver	Minor	1	Pain	Minor	None
14-Mar-2014	Vancouver	Minor	1	Lacerations, bruises	Minor	None
14-Mar-2014	Victoria	Minor	1	Laceration	Minor	None
1-May-2014	Victoria	Minor	1	Bruised knee, pain	Minor	None

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
Six people were taken to hospital and treated for suspected carbon monoxide poisoning after experiencing headaches, nausea and dizziness. A 'strange' odour was also reported.	Investigation revealed that the cause was attributed to an improperly installed venting system on a wall furnace. Testing verified that when the furnace was running, the combustion products were being distributed throughout the building through the main heating ducts. Multiple installation issues were found that would have contributed to the improper venting of the furnace: • The concentric venting was not installed correctly; the outer combustion air pipe was not brought down to the top of the furnace and hooked up; • The venting system terminated in the attic space; • The furnace had been enclosed in a closet with a solid door and only two small return air grills had been cut into the side walls. When the furnace was turned on it would try to draw air though the two small grills in the sides of the closet but would also draw products of combustion down from the attic. When the furnace was running the products of combustion could be drawn into the building through the improperly installed combustion air pipe and distributed throughout the trailer by the furnace blower.
The gas vent on a gas boiler imploded.	Foreign material (paper) was drawn into the combustion intake and created blockage at the combustion fan inlet.
A homeowner was alerted by his carbon monoxide (CO) detector indicated CO in the home.	The utility technician found the hot water boiler heat exchanger was plugged and producing the carbon monoxide that entered the house.
A resident in a multi-family residence reported a gas odour to the utility. The return air supply duct had been covered with a solid panel causing a negative condition in the water heater/furnace closet. This allowed the products of combustion from the water heater to enter the air system into the dwelling unit through the air filter opening in the furnace ducting. The odour was from the products of combustion. There was about 25 ppm carbon monoxide in the dwelling unit where the return air had been sealed.	The original venting configuration does not work and the water heater spills into the space. The sound insulating panel over the return air supply duct opening prevented the return air from entering into the forced air heating system. Openings in the return air duct located in the water heater/furnace closet created a negative condition in the space permitting the water heater products of combustion to enter the forced air return air ducting.
A fire occurred on the external surface of the furnace heat exchanger at a single family residence.	A foreign object entered the heating surface on a forced air furnace.
Emergency services responded to a carbon monoxide alarm at a single-family residence. Combustion products spilled from the boiler venting system into the home.	A hot water heating boiler produced the carbon monoxide that entered the home. The boiler had not been serviced in at least five years. The boiler burners and heat exchange became dirty, producing high levels of carbon monoxide in the products of combustion.
An explosion occurred within the boiler's combustion chamber.	Although the cause of the combustion/ignition problem was undetermined, regulated equipment/work is suspected to be involved.

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
A passenger reported that the elevator 'left the first floor (bottom) with a hard start when heading to the second floor' (sic).	Not recorded.
A passenger reported that the elevator travelled too fast.	Possible elevator shutdowns due to electrical wiring and over-speed valve.
An unlicensed, unqualified person performed regulated work on an elevator.	Not recorded.
A passenger fell at the escalator entrance.	The passenger was walking down the up-running escalator.
A passenger fell backwards and struck his elbow going down the escalator.	Loss of balance.
A passenger's hand was caught on the side door while the door was opening.	Passenger put hand on elevator door while the door opened.
A passenger's sleeve was caught in the escalator's handrail.	Loose clothing became caught in handrail, causing the passenger to fall.
The elevator was not completely level with the floor and a passenger tripped and fell as she exited the elevator.	Machine and circuits of elevator were not functioning properly.
A passenger lost his balance and fell down the escalator.	The passenger lost his balance.
A passenger slipped and fell on an escalator.	Unknown; insufficient information provided.
Staff could not get the rope gripper to reset. Without knowing the potential consequences, they pinned the rope gripper in the open position, rendering it ineffective, and returned the elevator to service.	Lack of understanding of elevator safety systems caused the decision to render a safety device inoperative.
A passenger placed her hand on the elevator door and it was drawn into the door pocket (area between hall door and car door).	Not recorded.
A passenger tripped as she exited the elevator.	The car was not level with the floor when the passenger began to exit.
A passenger's arm was struck as the elevator door was closing.	"Inattention? Unit went into nudging?" (sic)
An elevator door contacted a passenger.	Not recorded.
A passenger fell forward, sustaining injuries to his hands, face and legs on the thread plate edges.	Alcohol may have been a factor.
A passenger was injured while running up the 'down' escalator.	Rule violation; the passenger was running up the 'down' escalator.
A passenger riding the escalator with her walker fell at the top landing.	The person lost their balance at the top of the escalator.

Appendix A1 Incident Summaries Continued

TABLE A1-4: ELEVATING DEVICES INCIDENTS

INCIDENT DATE	CITY	INCIDENT RATING	QTY. INJURIES	INJURY DESCRIPTION	INJURY RATING	DAMAGE
2-May-2014	Surrey	Minor	0	NA	NA	None
5-May-2014	Richmond	Minor	1	Shoulder injury	Minor	None
7-May-2014	Surrey	Minor	1	Bruises, lacerations, pain	Minor	None
7-May-2014	Surrey	Minor	1	Cuts, bruises, pain	Minor	None
16-May-2014	Coquitlam	Minor	1	Bruises, pulled ligament	Minor	None
24-May-2014	New Westminster	Minor	1	Not specified	Minor	None
30-May-2014	Surrey	Minor	1	Not specified	Minor	None
9-Jun-2014	Richmond	Minor	1	Small lacerations	Minor	None
9-Jun-2014	Vancouver	Minor	1	Laceration, swollen ankle	Minor	None
10-Jun-2014	Vancouver	Minor	1	Not specified	Minor	None
10-Jun-2014	Surrey	Minor	1	Not specified	Minor	None
18-Jun-2014	Vancouver	Minor	1	Laceration	Minor	None
1-Jul-2014	Richmond	Minor	1	Lacerations, bruising	Minor	None
4-Jul-2014	Vancouver	Minor	0	NA	NA	None
7-Jul-2014	Vancouver	Minor	0	NA	NA	Unknown
7-Jul-2014	Vancouver	Minor	1	Laceration	Minor	None
21-Jul-2014	Coquitlam	Minor	1	Abrasion	Minor	None
22-Jul-2014	Vancouver	Minor	1	Laceration	Minor	None
23-Jul-2014	Victoria	Minor	1	Not specified	Minor	None
23-Jul-2014	North Vancouver	Minor	0	NA	NA	None
23-Jul-2014	Langford	Minor	1	"Pinch"	Minor	None
28-Jul-2014	Prince George	Minor	1	Small laceration	Minor	None
30-Jul-2014	Surrey	Minor	1	Pain	Minor	None
5-Aug-2014	Vancouver	Minor	1	Laceration	Minor	None
7-Aug-2014	Richmond	Minor	1	Not specified	Minor	Elevator hall door gib damaged
11-Aug-2014	Richmond	Minor	0	NA	NA	None
14-Aug-2014	Vancouver	Minor	1	Bruises	Minor	None
21-Aug-2014	Coquitlam	Minor	1	Lacerations	Minor	None
29-Aug-2014	Vancouver	Minor	1	Lacerations	Minor	None
30-Aug-2014	Surrey	Minor	1	Bruises, lacerations, pain	Minor	None
5-Sep-2014	Surrey	Minor	1	Abrasions	Minor	None
10-Sep-2014	Victoria	Minor	1	Not specified	Minor	None
10-Sep-2014	Vancouver	Minor	3	Lacerations, abrasions	Minor	None
12-Sep-2014	Surrey	Minor	1	Small lacerations	Minor	None
18-Sep-2014	Vancouver	Minor	1	Pain	Minor	None
20-Sep-2014	Vancouver	Minor	1	Fractured ankle	Major	None
22-Sep-2014	Victoria	Minor	1	Laceration	Minor	None
25-Sep-2014	North Vancouver	Minor	1	Bruises	Minor	None
28-Sep-2014	Vancouver	Minor	1	Not specified	Minor	Unknown

Appendix A1

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
"Fall report by STA" (sic).	Loss of balance.
An employee entered an elevator that was under maintenance and was injured when the door was commanded to close from the elevator controller.	Not recorded.
A passenger with rolling luggage lost her balance while stepping onto the escalator.	Bringing luggage onto escalator caused the passenger to lose her balance.
A passenger with a rolling suitcase lost her balance while stepping onto an escalator.	Loss of balance.
A passenger with a stroller lost his balance on an escalator and fell backwards.	Loss of balance.
Passenger "fell on unit".	Loss of balance.
A passenger fell on an escalator.	Not recorded.
A passenger ran up the escalator to catch a departing a train. The front of her sandal became caught on the step above, bent backwards, and her food scraped against the escalator's grating.	The passenger was running up the escalator.
A passenger was on the escalator with his bicycle and fell backwards.	The passenger lost his balance while holding his bicycle on the escalator.
A passenger was struck by a closing door.	Not recorded.
A passenger's hand was caught between the car door and car frame.	Not recorded.
Passenger "cut their foot"	Not recorded.
A passenger fell on an escalator.	The passenger lost his balance.
Heel of runner caught under comb plate.	Not recorded.
A passenger's shoe became caught between the escalator step and skirt.	Not recorded.
A passenger stumbled on the escalator.	Loss of balance.
A passenger fell as she was walking up an escalator.	Loss of balance.
A passenger with a suitcase fell backwards on an escalator.	Transporting a suitcase on escalator may have caused the passenger to lose her balance.
A passenger reported she was struck by cart from the 'cartveyor'.	Not recorded.
A passenger's rubber boot became caught in the escalator step.	Not recorded.
A passenger's fingers were pinched in a closing elevator door.	The passenger's hand may not have been in an area where the door re-opening device (infrared detector) could detect.
It was reported that a passenger fell on an escalator.	The passenger (a child) was possibly unattended.
A passenger fell on an escalator.	The passenger was carrying his walking aid, may not have seen the last step and fell.
A passenger was walking quickly up the escalator and stubbed his foot.	Loss of balance.
A passenger reported sustaining an injury while releasing himself from a stuck elevator.	Not recorded.
A passenger reported that the "elevator shakes and vibrates as it approaches the fifth floor."	Not recorded.
Elevator doors closed on a passenger's arms.	Not recorded.
A passenger's slippers came off his feet when riding on an escalator.	Not recorded.
A passenger fell on an escalator.	Loss of balance.
A passenger reported sustained injuries while on an escalator.	Not recorded.
A passenger fell while walking up the escalator.	The passenger may have miss-stepped at the top landing.
A passenger tripped and fell as he exited the elevator.	The elevator may have been out of level with the floor.
A passenger was trying to get onto the escalator when she lost her balance and fell backwards onto two other passengers. The other two passengers also fell.	Loss of balance.
A passenger's hand was caught between the car door and frame when the door opened.	Not recorded.
A passenger tripped as she entered the elevator.	The elevator was out of level with the floor.
A passenger was entering the elevator, the doors began to close. The passenger then tripped and fell.	Not recorded.
A passenger fell backwards as she stepped onto the escalator.	Loss of balance.
A passenger was bumped by the elevator door as she was exiting the elevator.	Not recorded.
A passenger fell on an escalator.	Not recorded.

Appendix A1 Incident Summaries Continued

TABLE A1-4: ELEVATING DEVICES INCIDENTS

INCIDENT DATE	CITY	INCIDENT RATING	QTY. INJURIES	INJURY DESCRIPTION	INJURY RATING	DAMAGE
30-Sep-2014	Victoria	Minor	1	Lacerations	Minor	None
1-Oct-2014	Surrey	Minor	1	Not specified	Minor	None
2-Oct-2014	Vancouver	Minor	1	Not specified	Minor	Unknown
5-Oct-2014	Victoria	Minor	1	Not specified	Minor	None
10-Oct-2014	Vancouver	Minor	1	Laceration	Minor	None
12-Oct-2014	North Vancouver	Minor	0	NA	NA	None
14-Oct-2014	Vancouver	Minor	1	Not specified	Minor	None
19-Oct-2014	Vancouver	Minor	1	Not specified	Minor	Unknown
24-Oct-2014	Vancouver	Minor	1	Bruise, laceration	Minor	None
7-Nov-2014	Courtenay	Minor	1	Pain	Minor	None
17-Nov-2014	Surrey	Minor	1	Not specified	Minor	None
2-Dec-2014	Victoria	Minor	1	Neck, back pain; dizziness, ringing in ears	Major	None
4-Dec-2014	Vancouver	Minor	0	NA	NA	None
4 Dec 2014	Squamish	Minor	1	Bruises	Minor	None

TABLE A1-5: RAILWAYS ACCIDENTS AND INCIDENTS

TYPE OF RAILWAY	DATE	ACCIDENT INCIDENT	DANGEROUS GOODS	INJURY OR FATALITY
Industrial	2-Jan-2014	Accident	No	No
Common Carrier	8-Jan-2014	Accident	No	No
Commuter	8 Jan 2014	Accident	No	Minor Injury
Industrial	9-Jan-2014	Accident	No	No
Common Carrier	9-Jan-2014	Accident	No	No
Siding & Spur	11-Jan-2014	Accident	No	No
Common Carrier	15-Jan-2014	Accident	No	No
Siding & Spur	16-Jan-2014	Accident	No	No
Common Carrier	22-Jan-2014	Incident	Yes	No
Siding & Spur	27-Jan-2014	Accident	No	No
Common Carrier	6-Feb-2014	Accident	Yes	No
Siding & Spur	17-Feb-2014	Accident	No	No
Industrial	18-Feb-2014	Accident	Yes	No
Common Carrier	21-Feb-2014	Accident	No	No
Common Carrier	21-Feb-2014	Accident	No	Fatality
Siding & Spur	23-Feb-2014	Incident	No	No
Siding & Spur	27-Feb-2014	Accident	No	No
Industrial	1-Mar-2014	Accident	No	No
Commuter	14-Mar-2014	Incident	No	No
Common Carrier	24-Mar-2014	Accident	No	No

Appendix A1

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
A passenger lost her balance and fell while on the escalator.	Loss of balance.
A passenger entered the escalator, lost his balance and fell.	Loss of balance.
A passenger reported tripping while exiting the elevator.	Not recorded.
A passenger fell while exiting at the top of the escalator.	Not recorded.
A passenger fell on an escalator.	Loss of balance.
Car #2 has safeties activated. Governor rope detached from car top. Two people were trapped in car at second floor.	The car had undergone a modification without a permit. The governor is tripping at low speed; having extra load in the car and a low-tripping governor lead to the safety engagement and entrapment.
A passenger fell while exiting the escalator.	Loss of balance.
A passenger tripped.	Car was six inches out of level with the floor.
A passenger fell backwards on an escalator.	Loss of balance.
A passenger entered the elevator while the elevator mechanic was performing a periodic test. The passenger was in the elevator when it stalled.	The passenger entered the elevator, unaware that it was not in service.
A passenger entered the elevator and tripped.	The car was out of level with the floor.
The elevator stopped during travel; brake dropped during travel.	Elevator stopped between floors.
The car descended to the buffers with full load in the car and two persons on top approximately 125% of rated capacity.	The brake spring may be suffering fatigue and needed more tension.
The front wheels of a passenger's wheelchair became wedged in the elevator sill gap.	Not recorded.

DESCRIPTION	RISK ASSESSMENT
Freezing and thawing caused an ice build up in the flange causing the trackmobile to derail.	Minor
When running around cars in yard, crew ran through switch. No dangerous or derailment.	Minor
Female lost her balance and hit her hood on door handle when train was arriving at station.	Minor
When switching cars, car mover lifted end of car for traction. When going thru switch cars front trucks went down different track than rear trucks and derailed, car was leaning 45 degrees to one side.	Major
Crew released brakes on set of cars. Cars started to roll uncontrolled and hit derail. After hitting derail, one car derailed.	Major
Operator was backing up train and chute got caught on one of the cars, damaging car and chute.	Minor
When pushing cars into clients spur one car derailed on the switch.	Minor
The load out operator over plowed off the top of the 141st rail car, spilling coal onto the track. The 141st and 142nd railcars derailed as a result of the spilled coal.	Minor
When switching cars conductor smelled an unknown commodity and evacuated area. It was found that an Anhydrous Ammonia car was leaking from the pressure relief valve o rings and product was evaporating. Product was not leaking to ground. Content of car was eventually transferred and car sent back to consignor.	Minor
When loading coal cars, coal spilled between cars and one car walked up on product and derailed.	Minor
Pulling cars out of a track, stopped movement and found a piece of asphalt had made contact with the locomotive and punctured holes in the fuel tanks. Approximately 1500-2000 litres of fuel spilled.	Minor
After off loading shovel parts at the Line Creek spur a unit arrived and proceeded to pick up the empty flat deck cars, while proceeding forward the rail cars rear set of trucks derailed on ice and snow buildup.	Minor
CN Pulling empty Hydrate car, car derailed over crossing in plant due to build up of ice in the flange.	Minor
Using engine CP 5796 the 1330 TTR crew pulled one car DTTX 751636 east out South 1 west and were moving it to track P1. As the movement proceeded west towards P1 the first three platforms went towards P1 but the fourth platform (B-end) went towards the east leg. Split Switch, no derailment, not reportable	Minor
A switching crew working in the Young Road railway crossing area in Chilliwack found a deceased male that had been struck by a train. A BCSA Railway Safety Officer attended the scene and initial investigation results are indicating that the incident may have been a suicide or an unsuccessful attempt to go from one side of the tracks to the other side by crawling under a train that was stopped momentarily while switching.	Severe
While loading coal, train came apart and head end portion of train became uncontrollable after emergency air was depleted by repeated emergency applications. Train passed a CTC signal.	Severe
Chute lowered between cars, small spill caused front truck of car to walk off, one car derailed.	Minor
While CN rail was spotting empty railcars on site they had three cars derail due to ice and snow buildup.	Minor
Guide way shifted on pillar. Repaired on April 14, 2014	Severe
Yard crew pushing cars through switch, lead set of wheels on one car derailed. Ties under switch were pumping leading to derailment.	Minor

Appendix A1 Incident Summaries Continued

TABLE A1-5: RAILWAYS ACCIDENTS AND INCIDENTS

TYPE OF RAILWAY	DATE	ACCIDENT INCIDENT	DANGEROUS GOODS	INJURY OR FATALITY
Industrial	2-Jan-2014	Accident	No	No
Common Carrier	8-Jan-2014	Accident	No	No
Commuter	8-Jan-2014	Accident	No	Minor Injury
Industrial	9-Jan-2014	Accident	No	No
Common Carrier	9-Jan-2014	Accident	No	No
Siding & Spur	11-Jan-2014	Accident	No	No
Common Carrier	15-Jan-2014	Accident	No	No
Siding & Spur	16-Jan-2014	Accident	No	No
Common Carrier	22-Jan-2014	Incident	Yes	No
Siding & Spur	27-Jan-2014	Accident	No	No
Common Carrier	6-Feb-2014	Accident	Yes	No
Siding & Spur	17-Feb-2014	Accident	No	No
Industrial	18-Feb-2014	Accident	Yes	No
Common Carrier	21-Feb-2014	Accident	No	No
Common Carrier	21-Feb-2014	Accident	No	Fatality
Siding & Spur	23-Feb-2014	Incident	No	No
Siding & Spur	27-Feb-2014	Accident	No	No
Industrial	1-Mar-2014	Accident	No	No
Commuter	14-Mar-2014	Incident	No	No
Common Carrier	24-Mar-2014	Accident	No	No
Common Carrier	27-Mar-2014	Accident	No	No
Common Carrier	27-Mar-2014	Accident	No	No
Industrial	1-Apr-2014	Accident	No	No
Common Carrier	6-Apr-2014	Accident	No	Major Injury
Industrial	8-Apr-2014	Accident	No	No
Siding & Spur	10-Apr-2014	Accident	No	No
Industrial	10-Apr-2014	Accident	Yes	No
Industrial	15-Apr-2014	Accident	No	No
Common Carrier	17-Apr-2014	Incident	Yes	No
Industrial	21-Apr-2014	Accident	No	No
Industrial	23-Apr-2014	Incident	No	No
Common Carrier	24-Apr-2014	Accident	No	Minor Injury
Common Carrier	24-Apr-2014	Accident	No	No
Common Carrier	26-Apr-2014	Accident	No	No
Common Carrier	27-Apr-2014	Accident	No	No
Commuter	27-Apr-2014	Incident	No	No
Industrial	1-May-2014	Accident	No	No

Appendix A1

DESCRIPTION	RISK ASSESSMENT
Freezing and thawing caused an ice build up in the flange causing the trackmobile to derail.	Minor
When running around cars in yard, crew ran through switch. No dangerous or derailment.	Minor
Female lost her balance and hit her head on door handle when train was arriving at station.	Minor
When switching cars, car mover lifted end of car for traction. When going thru switch cars front trucks went down different track than rear trucks and derailed, car was leaning 45 degrees to one side.	Major
Crew released brakes on set of cars. Cars started to roll uncontrolled and hit derail. After hitting derail, one car derailed.	Major
Operator was backing up train and chute got caught on one of the cars, damaging car and chute.	Minor
When pushing cars into clients spur one car derailed on the switch	Minor
The load out operator over plowed off the top of the 141st rail car, spilling coal onto the track. The 141st and 142nd railcars derailed as a result of the spilled coal.	Minor
When switching cars conductor smelled an unknown commodity and evacuated area. It was found that an Anhydrous Ammonia car was leaking from the pressure relief valve o rings and product was evaporating. Product was not leaking to ground. Content of car was eventually transferred and car sent back to consignor.	Minor
When loading coal cars, coal spilled between cars and one car walked up on product and derailed.	Minor
Pulling cars out of a track, stopped movement and found a piece of asphalt had made contact with the locomotive and punctured holes in the fuel tanks. Approximately 1500-2000 litres of fuel spilled.	Minor
After off loading shovel parts at the Line Creek spur a unit arrived and proceeded to pick up the empty flat deck cars, while proceeding forward the rail cars rear set of trucks derailed on ice and snow buildup.	Minor
CN Pulling empty Hydrate car, car derailed over crossing in plant due to build up of ice in the flange.	Minor
Using engine CP 5796 the 1330 TTR crew pulled one car DTTX 751636 east out South 1 west and were moving it to track P1. As the movement proceeded west towards P1 the first three platforms went towards P1 but the fourth platform (B-end) went towards the east leg. Split Switch, no derailment, not reportable	Minor
A switching crew working in the Young Road railway crossing area in Chilliwack found a deceased male that had been struck by a train. A BCSA Railway Safety Officer attended the scene and initial investigation results are indicating that the incident may have been a suicide or an unsuccessful attempt to go from one side of the tracks to the other side by crawling under a train that was stopped momentarily while switching.	Severe
While loading coal, train came apart and head end portion of train became uncontrollable after emergency air was depleted by repeated emergency applications. Train passed a CTC signal.	Severe
Chute lowered between cars, small spill caused front truck of car to walk off, one car derailed.	Minor
While CN rail was spotting empty railcars on site they had three cars derail due to ice and snow buildup.	Minor
Guide way shifted on pillar. Repaired on April 14, 2014	Severe
Yard crew pushing cars through switch, lead set of wheels on one car derailed. Ties under switch were pumping leading to derailment.	Minor
A loaded gravel barge travelling downstream through the south channel hit the south pier of the Queensborough rail bridge. The pier was damaged and shifted a small amount which was confirmed by a survey. The bridge was removed from service until a detailed inspection could be performed. A supporting element was added to insure stability and the bridge was returned to service.	Major
Pushing cars through switch when two cars derailed, split the switch.	Minor
When pulling out of bad order storage track an air reservoir broke off on a car 20 car lengths back. A car struck the reservoir and derailed.	Minor
A Southern Railway train was involved in a collision with a Kubota farm tractor that was also towing a flatbed utility trailer at the South Sumas Road uncontrolled railway crossing in Chilliwack.	Severe
Crew made a joint on two cuts of cars in the north end of loading track then pushed south and made a joint on the load under the loading facility. The cars came apart between the second and third cars from the north end. Five cars ran uncontrolled south on track P8 and struck the end of track stop blocks. The south load derailed. Cars not on air and no hand brakes applied. Tug test not performed after cars were connected.	Severe
Loading a rail car with lumber when it was struck by an unsecured loaded car which rolled back down the grade.	Severe
Empty 302 car split switch and two front wheels of "A" end of car left track. All other wheels of front truck stayed on track. No injuries	Minor
Backing up with 20 cars, derailed locomotive after they had inadvertently split the switch with the forward movement.	Major
Crew switching 3 empty dangerous goods cars. Thought they smelled some vapours from there cars. Cars checked out, no leaks.	Minor
When car on chip dumper spring loaded bumper device bent, pushing knuckle to side causing rail car to move to the side and derail one set of wheels.	Minor
Conductor was riding on chip car ladder when stirrups rapidly swung inward causing him to almost fall off equipment.	Major
Southbound freight train struck a pedestrian trespassing on the tracks while walking his dog. Ambulance attended.	Severe
Crew was pushing into the caboose track at Huntingdon yard when conductor heard a noise and stopped movement. Crew discovered one car had derailed and rerailed itself on the guard rail.	Minor
Crew pushing into yard track, one car climbed up on the switch derailing one set of trucks. Awe damper on car was uneven contributing to derailment.	Minor
An empty barge being towed by a tug travelling downstream through the south channel struck a temporary pier protection pile, causing the rear of the barge to fishtail and wedge against the main protection pier. Minor damage was sustained by the protection pier. There was no disruption to train service.	Minor
Female jumped into guideway in front of outbound approaching train. Guideway intrusion devices activated and train emergency braked. Train stopped short of female. Ambulance took female to hospital. No injuries reported.	Minor
Track mobile derailed when a three foot piece of rail broke when track mobile was operating over the section of track.	Major

Appendix A1 Incident Summaries Continued

TABLE A1-5: RAILWAYS ACCIDENTS AND INCIDENTS

TYPE OF RAILWAY	DATE	ACCIDENT INCIDENT	DANGEROUS GOODS	INJURY OR FATALITY
Industrial	1-May-2014	Accident	No	No
Industrial	1-May-2014	Accident	No	Minor Injury
Industrial	4-May-2014	Accident	No	No
Industrial	5-May-2014	Accident	No	No
Siding & Spur	6-May-2014	Accident	No	No
Industrial	6-May-2014	Accident	No	No
Common Carrier	6-May-2014	Accident	No	No
Commuter	6-May-2014	Accident	No	Fatality
Commuter	20-May-2014	Accident	No	Minor Injury
Common Carrier	21-May-2014	Accident	No	No
Industrial	21-May-2014	Accident	No	No
Commuter	22-May-2014	Incident	No	No
Industrial	25-May-2014	Accident	No	No
Common Carrier	25-May-2014	Accident	No	Minor Injury
Common Carrier	27-May-2014	Accident	No	No
Common Carrier	28-May-2014	Accident	No	No
Commuter	31-May-2014	Accident	No	Fatality
Industrial	3-Jun-2014	Accident	No	No
Siding & Spur	3-Jun-2014	Accident	No	No
Common Carrier	5-Jun-2014	Accident	No	No
Industrial	11-Jun-2014	Accident	No	No
Commuter	17-Jun-2014	Incident	No	No
Industrial	19-Jun-2014	Accident	No	No
Industrial	24-Jun-2014	Accident	Yes	No
Common Carrier	25-Jun-2014	Accident	No	No
Industrial	25-Jun-2014	Accident	No	No
Industrial	14-Jul-2014	Accident	No	No
Industrial	22-Jul-2014	Incident	No	No
Siding & Spur	25-Jul-2014	Accident	???	No
Common Carrie	27-Jul-2014	Accident	No	No
Siding & Spur	29-Jul-2014	Accident	No	No
Siding & Spur	30-Jul-2014	Accident	No	No
Common Carrier	31-Jul-2014	Accident	No	No
Industrial	31-Jul-2014	Incident	No	No

Appendix A1

DESCRIPTION	RISK ASSESSMENT
After derailing track mobile over a broken rail, railway re railed machine and put rubber tires down to run around and switch from other end. Operator did not have rubber tires aligned properly when rail bogies were reset. When the crew started to push again the track mobile derailed.	Minor
Crew intended to push cars down track one, but switch was misaligned and they went down track 2 colliding with the cars in that track. The track mobile operator was jarred and was required to seek medical attention. Operator returned to work.	Major
While CN was switching the cattle catcher on, the engine caught the open derailer and dragged it down the track causing damage to the derail and two ties.	Minor
While CN was switching the cattle catcher on, the engine caught the open derailer. Damage to derail, ties and CN engine.	Minor
Locomotive came in contact with loading chute. Damage to engine antennas.	Minor
Work Train 302 was just starting to pull empty cars off of the Dryland Sort when a Stacker (machine that lifts the loads off of the cars) came to fuel up. As the Stacker approached the head end of the train, a small firewood size chunk of wood shot out from the tire of the Stacker (about 20 - 25 feet away) and wedged under the wheel of the first axel of the first car and put it on the ground. Brakeman was right there, close by and signalled the train to stop. No injuries or damage.	Minor
Pulled through semi automatic switch, only the leading truck of the unit trailed thought the switch. Movement came to a stop and reversed, switch had not lined back for lead and leading truck travelled down the wrong track.	Major
Male jumped in front of an arriving train on the Inbound platform at Brentwood station. All systems performed as intended. Male died on the scene.	Minor
Female passenger exited train at Broadway station, while walking down the platform she stumbled into the side of the departing train and was struck in the head. Taken to hospital for cuts and abrasions.	Minor
Crew did not properly line switch causing engine to derail when it pushed through switch.	Major
Switch #4 was lined against the intended movement and a train travelled through the switch causing damage to the switch connecting rod.	Major
Control room operator removed ATC protection while guideway tech was in guideway with a train in the area. When the protection was removed the train moved through the area the tech was occupying. The guideway tech jumped clear to avoid being hit by train.	Severe
While pulling string of loads into place on track 6, the track mobile operator felt movement in the cars and started to slow to a stop. The operator felt a second movement and came to a complete stop. Operator exited trackmobile to find 1st car in string had derailed.	Minor
Train was returning eastbound into yard, pushing two loads and four empties. Upon going over road crossing one loaded rail car derailed all wheels and both set of trucks. The trainman detrained and injured elbow and chest area and was taken to hospital for evaluation.	Major
Southbound freight train into emergency at crossing mile 58.9 Victoria sub. Westbound logging truck failed to stop at the gates, ripping gates off. Train did not hit the truck - near miss.	Major
A train was travelling with two loads and eight empties as it approached the 272nd St crossing when it struck a Ford F150 pick up truck that failed to stop at the stop sign. Some damage occurred to the locomotive and passenger vehicle but no injuries.	Minor
An elderly man jumped in front of a train at Waterfront Station. All systems performed as intended. Passenger was confirmed deceased at the scene.	Minor
CN was pulling empty log cars and derailed eight cars. Off-centre log car may have exerted force on rail causing it to roll, possible pre-existing damage to rail.	Minor
When moving cars down to spot, north car rolled away and went over derail. Derailed one set of trucks on car HWCX 3272. Operator did not check to make sure cars coupled properly.	Severe
Crew pulling a cut of 12 loads and three empties two cars derailed in Wellcox yard.	Minor
An empty logging truck approaching crossing when lights were activated attempted to cross before the gates came down. The gate caught on last bunk of trailer and was ripped off pivot. Train went into emergency and stopped well short of logging truck.	Minor
While placing gantry truss in place the bolts or weld gave way. This resulted in the super beam dropping 3 meters onto the column. Investigation revealed that operator error was the cause.	Severe
Low Speed Contact between shuttle bus and locomotive at an internal plant crossing. No injuries reported and full investigation with corrective actions completed by the railway.	Severe
Locomotive crew from CN was switching chemical cars, the field operator stated that the operator hit forward instead of reverse, the co operator hit the emergency stop, but the acid car hit the backstop mechanism before the train could be stopped. Some backstop structural damage, cylinder block wall damage occurred.	Minor
Train crew was making a pushing movement with 12 empties destined into a clear track. Two railcars made it towards the clear track, when the 3rd car climbed the switch point and derailed. Two wheels and one set of trucks derailed.	Minor
A lone loaded chip car was left on the spur track immediately after a CN switch. It appeared insufficient brakes were applied on the railcar. The lone car travelled down the tracks and over the derail. All four trucks were off the rails.	Severe
Locomotive ran past stop block, pushed parked trackmobile past stop block, two wheels also off on the locomotive. Locomotive was controlled remotely.	Major
CN entered company track with 12 empties and coupled up to the 10 empties that were already in yard. After connecting they then pushed back, with the conductor standing where the coupling was made, over the blue flag, into 8 loaded cars with hand brakes applied and then over a crossing. Stopping just short of a derail. CN conductor was not in a position to watch point. No injuries.	Severe
Loaded logging truck at crossing with Cross bucks and stop sign proceeded in front of CN train. Train hit logging truck resulting in engine and 5 car derailment. Minor injuries, with no transportation to hospital.	Severe
While completing the train dumping, locomotive engineer was doing his final inspections and inadvertently put the trailing unit into run causing the last three cars to move through the dumper damaging the index arm pins.	Minor
While moving one car with winch, car failed to stop when handbrake was applied causing car to roll uncontrolled into stop chock. Car did not derail, no injuries.	Minor
Packer unit fell down when middle engine was moving underneath it. Rad cover on right hand side was peeled back. Continued loading cars. Unit to be repaired.	Minor
Derailed five loads of coal at the entrance to the dumper, suspected broken rail.	Major
Crew coupled onto nine empty cars, cut off two and spotted cars, leaving seven cars. When CN came in to set off nine more cars crew found that no hand brakes were set on the seven remaining cars.	Severe

Appendix A1 Incident Summaries Continued

TABLE A1-5: RAILWAYS ACCIDENTS AND INCIDENTS

TYPE OF RAILWAY	DATE	ACCIDENT INCIDENT	DANGEROUS GOODS	INJURY OR FATALITY
Industrial	1-Aug-2014	Accident	No	No
Common Carrier	1-Aug-2014	Accident	No	No
Commuter	1-Aug-2014	Accident	No	Fatality
Commuter	9-Aug-2014	Accident	No	Major Injury
Heritage	14-Aug-2014	Incident	No	No
Industrial	21-Aug-2014	Accident	No	No
Industrial	22 Aug 2014	Accident	Yes	No
Common Carrier	2-Sep-2014	Accident	No	No
Common Carrier	4-Sep-2014	Accident	No	No
Common Carrier	5-Sep-2014	Incident	Yes	No
Industrial	5-Sep-2014	Accident	No	No
Industrial	7 Sep 2014	Accident	No	No
Common Carrier	15-Sep-2014	Accident	No	No
Commuter	16-Sep-2014	Accident	No	Minor Injury
Common Carrier	18-Sep-2014	Accident	No	No
Industrial	19-Sep-2014	Accident	Yes	No
Industrial	19-Sep-2014	Accident	No	No
Common Carrier	22-Sep-2014	Accident	Yes	No
Common Carrier	23-Sep-2014	Accident	Yes	No
Commuter	23-Sep-2014	Accident	No	Major Injury
Commuter	23-Sep-2014	Accident	No	Fatality
Commuter	27-Sep-2014	Accident	No	Minor Injury
Industrial	9 Oct 2014	Accident	No	No
Siding & Spur	9-Oct-2014	Accident	No	No
Common Carrier	14-Oct-2014	Accident	No	Minor Injury
Common Carrier	17-Oct-2014	Accident	No	Minor Injury
Industrial	25-Oct-2014	Accident	No	No
Common Carrier	27-Oct-2014	Accident	No	No
Industrial	4-Nov-2014	Accident	No	No
Common Carrier	5-Nov-2014	Accident	No	No
Common Carrier	6-Nov-2014	Accident	No	No
Industrial	7-Nov-2014	Accident	No	No

Appendix A1

DESCRIPTION	RISK ASSESSMENT
While spotting cars CN crew pushed cars into backstop pile causing one car to derail.	Minor
While pushing 26 loads and two empties with three units, the track under load kinked out due to heat causing the second unit in the consist to derail.	Minor
Male patron jumped in front of outbound train zero end of platform. Guideway intrusion devises worked as intended. Patron was on life support when emergency personnel removed him from the station. It was later reported that the patron died as a result of the accident.	Minor
Male stumbled and fell against side of train when it was leaving station. STA caught male caught person before he fell into guideway. Taken to hospital with head injuries.	Minor
Train was backing across Athol Street, a passive crossing, (towards Station) with the Conductor riding the point. A black pickup crossed in front of the water car, without stopping. The driver did not appear to notice the train, nor hear the warning whistle.	Major
While switching a string of 12 cars, six cars separated and ran freely until they hit the derailer. One set of trucks derailed on one car.	Severe
Dangerous Goods car (Peroxide) derailed one wheel on the ground, no injuries and no damage to the tank car. Pushing four cars the leading car hit the derail after the employee on the point failed to see it in the derailing position.	Major
While shoving into customers track one car picked switch and derailed, travelling 60 feet on the ground from point of derailment.	Minor
A rail car picked the track 4 switch and derailed travelling approximately 60 feet on the ground. This after two other rail cars had gone through the switch. No injuries, no dangerous goods.	Minor
An odor was detected coming from a Dangerous Goods Car however rail crew could not see a visible leak. Fire department, Transport Canada and Canutec were notified. A leak was later detected and the railcar was quarantined and offloaded by a qualified 3rd party. Once secure the bad order car was moved to its home shop for repair.	Severe
When switching cars track mobile operator noticed smoke coming from engine compartment. Once help arrived crew put out fire in engine compartment.	Minor
Pushing loaded cars from the warehouse to couple to empty cars on another track. Loader operator failed to observe switch points and derailed one car.	Major
At 21:23 a vehicle travelling east on Townshipline Road in Abbotsford struck a BNSF train of a 124-car empty coal train. The car involved sustained minor damage to the B-End of the stirrup and operating lever on the left side but there was no apparent track damage.	Severe
Female patron intentionally entered the guideway in front of an outbound train. The train emergency braked but came into contact with patron. Patron was able to exit guideway and was later located and taken to hospital for minor injuries.	Minor
While loading a truck with lumber a forklift backed in front of rail cars that were being moved. Damage to both forklift and rail car. No injuries.	Major
While pulling ahead the track mobile and the first car cleared switch 11. The following car's front truck went through the switch and progressed down the line. This caused the first car to torque upward and the south side wheels of the truck rose up and off the track. Train was dynamited and full stop was achieved within a couple of feet.	Major
Crew pushing back empty cars into yard track, had not ensured joint was made on the last two cars. Resulting uncontrolled movement put one set of wheels on the last car over the stop blocks.	Major
While holding onto 15 cars to spot five cars into customers track the leading axle of an asphalt car split the switch points, resulting one axle on the A-end of railcar to derail.	Minor
A train crew lost control of a dangerous goods railcar while switching at a rail siding in Abbotsford resulting in a derailment. The crew was attempting to temporarily stage a single dangerous goods car in the siding in order to complete some additional work in the area. As the railcar was shoved into the siding the ground crew member was unable to apply the handbrake resulting in an uncontrolled movement. The lone railcar traveled unattended the length of the siding and eventually struck a derail that was in place at the North end of the siding to protect the mainline track. The derail worked as intended and the railcar derailed coming to a rest in a ditch on the east side of the track. The Abbotsford Fire Department and a Hazmat Team attended the scene and determined that the railcar was not leaking and it did not pose any immediate danger to the surrounding area. There were no reported injuries resulting from the accident.	Severe
Female patron entered platform area of station at east end and started to walk to west end. When train was arriving at station patron veered towards train and was struck by the front right corner of lead coach. Patron fell to platform and was taken to hospital with serious injuries.	Minor
A female patron was waiting approximately half way down the platform, as the train approached the station the female jumped into the guideway and lay down just before the train passed over her. The platform intrusion system activated when the female landed in the guideway and the train emergency braked but was unable to stop to avoid contacting the female.	Minor
STA noticed male acting irrational and walking along the yellow tactile edge at Main Street Station. STA tried to coax male away from guideway. Male went into guideway and as the train approached he jumped out when his foot got hit by the train. Transit Police called and attended. Male was escorted from station by Transit Constable.	Minor
Rail crew was pushing a loaded boxcar onto barge when the last set of trucks climbed the rail extension between the ramp and barge and derailed. The brakeman was not in a position to observe as per procedure.	Minor
Operator ran through switch with chip car. Did not confirm which way the switch points were lined before pushing car through switch.	Major
Vehicle travelling south on Lickman Road failed to stop at crossing controlled by stop sign and cross bucks. Train travelling east made emergency brake application but was unable to avoid colliding with vehicle. Lone occupant of vehicle sustained minor injuries.	Major
After train arrived at station, male patron exited the train and went to designated waiting area. As the train started to depart the station the male stumbled forward and fell against departing train. Male then fell back onto platform. Emergency services attended.	Minor
When picking up a string of cars CN pushed back into cars that were parked foul on an adjacent track. Minor damage to cars, no injuries.	Major
TTR 0800 yard crew pulled train out of yard track and left them on the South lead. TTR 1330 yard crew pushed cars and side swiped cars left by the 0800 yard, crew member failed to line switch.	Major
Cars were spotted by a previous crew through cross over, all cars were connected through switch, loader was pushing cars through cross over to connect with cars on warehouse track. The x-over switch #5 was between car DWC 566552 the leading truck was clear of the switch and on the x-over however the switch was lined for the tangent track and when the movement was pushed forward the trailing truck stayed on the tangent forcing the leading truck to derail after the frog on the x-over.	Minor
Train, travelling light engines, approaching crossing equipped with stop sign and cross bucks at 10 mph with headlights and ditch lights illuminated, bell and horn. Train crew seen pick up with trailer approaching crossing not slowing down. Train was put into emergency braking and came to stop on crossing. Front of vehicle just came into contact with train. No injuries, minor damage to vehicle.	Minor
Crew was kicking non hazardous equipment when a single car was kicked onto three cars which had previously been kicked into track. The single car bypassed knuckles resulting in the rail rolling and two cars derailing.	Major
Single empty chip car ran uncontrolled through and damaged switch. Car was improperly secured.	Major

Appendix A1 Incident Summaries Continued

TABLE A1-5: RAILWAYS ACCIDENTS AND INCIDENTS

TYPE OF RAILWAY	DATE	ACCIDENT INCIDENT	DANGEROUS GOODS	INJURY OR FATALITY
Common Carrier	8-Nov-2014	Accident	No	Fatality
Industrial	21-Nov-2014	Accident	Yes	No
Industrial	22-Nov-2014	Accident	No	No
Siding & Spur	24-Nov-2014	Accident	No	No
Industrial	25-Nov-2014	Accident	No	No
Industrial	27-Nov-2014	Accident	No	No
Common Carrier	29-Nov-2014	Accident	No	No
Commuter	29-Nov-2014	Incident	No	No
Common Carrier	1-Dec-2014	Accident	No	No
Commuter	3-Dec-2014	Accident	No	Major Injury
Industrial	4-Dec-2014	Accident	No	No
Industrial	5-Dec-2014	Accident	Yes	No
Siding & Spur	9-Dec-2014	Accident	No	No
Siding & Spur	9-Dec-2014	Accident	No	No
Common Carrier	17-Dec-2014	Accident	No	Major Injury
Siding & Spur	17-Dec-2014	Accident	No	No
Commuter	20-Dec-2014	Incident	No	No
Industrial	22-Dec-2014	Accident	No	No
Industrial	22-Dec-2014	Accident	No	No
Common Carrier	23-Dec-2014	Accident	No	No
Industrial	29-Dec-2014	Accident	No	No
Common Carrier	29-Dec-2014	Accident	No	Minor Injury
Industrial	29-Dec-2014	Accident	No	No
Common Carrier	31-Dec-2014	Accident	No	No
Siding & Spur	31-Dec-2014	Accident	No	No

DESCRIPTION	RISK ASSESSMENT
A vehicle proceeding east on Townshipline Road failed to stop at a crossing equipped with advance warning signs, cross bucks and stops signs. The vehicle struck the side of an empty BNSF coal train travelling south on Southern Railway of British Columbia's (SRY) Fraser Valley Subdivision (FVS). The lone occupant of the vehicle did not survive the collision. The vehicle struck the 99th car of a 123 car train. When the vehicle struck the train it derailed one set of trucks on the railcar. The train crew had no indication they had a derailed car and proceeded south, dragging the car just over two miles. At this point the railcar fully derailed and struck two power poles, which fell against the side of the train. The train emergency braked and the conductor went back to find that three cars had derailed. Power was lost in this area and three crossings were blocked for several hours.	Severe
Pick up truck, driving by company employee, rolled and came into contact with two stationary TDG cars. No damage to rail cars, damage to side of vehicle.	Minor
The railcar loader pushed 2 cars up to connect to 2 more empty cars on the south track. After connecting to the south cars he hooked up the air and allowed it to charge, then tug tested to ensure it was secure. The railcar loader brought all 4 empty cars back to the loading area and dynamites the brakes then set the hand brakes on the last two cars then tug tested and disconnected the track mobile. As the track mobile operator was walking back he noticed the last two cars in the string started to roll down the track towards the derail. the rail cars hit the derail and came off the track.	Severe
Loaded train was shut down in loop and CP was given the go ahead to take train. It was discovered after the CP crew left that the unit on the tail ends GPS was damaged by the loading shoot when train pulled.	Minor
Track mobile lifted car for traction and lifted too high causing car body to come off center casting.	Minor
Pushing cars in yard track, ice and snow build up at crossing, two cars derailed.	Minor
While pushing 19 loaded and two empty intermodal cars over a switch the middle platform on a three platform car derailed on the switch. It was found that the cause of the accident was that the car was off its center casting.	Minor
A male stepped backwards, slipped on the yellow tactile edge and fell into the guideway just as the train was arriving. The train emergency braked. He managed to pull himself out and narrowly avoided the train contacting him.	Minor
Pulling 10 cars eastward at 8 mph, cars 6 to 9 loaded grain cars derailed on their side, car 10 stayed upright with one set of wheels derailed. Compromise joint bar broke under load of train.	Major
Female intentionally jumped in front of incoming train. Train emergency braked and came into contact with female, she was pushed down the guideway and was able to exit guideway without assistance. Taken to hospital with minor injuries.	Minor
When pulling chip cars down main track, operator failed to ensure all switches were lined for movement and ran through track 7 switch. When he went to push cars into track 8, two cars that were over the track 7 switch derailed.	Minor
Sodium Hydroxide car was spotted in chemical preparation area. It was later discovered the car had rolled and hit warehouse door.	Minor
When loading train the load out operator advised the locomotive engineer to move forward. The train lunged backward and one of the rail cars came into contact with the loading shoot.	Minor
CN crew derailed a car at a yard road crossing, flange had become fouled with mud and debris then froze with the drop in temperature.	Minor
Yard crew switching on Annacis Island. Train stopped at Derwent road crossing, a pedestrian attempted to climb between cars to cross the road when the train moved and the pedestrian was injured, possible broken leg.	Major
An empty center beam flat car was being pushed into the loading area when one set of wheels derailed.	Minor
Main cable from collector shoe fuse box to main power feed shorted to frame causing arcing. Train emergency braked and came to a stop just outside station. Train was evacuated and station was cleared before train could be towed into station, police and fire crews attended.	Major
Second set of 1st truck wheels derailed when travelling thru a switch.	Minor
No report received.	Minor
Two engines derailed.	Major
When sporting cars into sulphuric acid track one set of trucks on the locomotive derail account wide gauge.	Minor
Motor vehicle travelling Northbound on 160th street struck by Westbound CN Light engines. Driver failed to stop at crossing protected by stop signs and crossbucks. Driver suffered minor injuries and taken to hospital.	Minor
Track mobile had a tire with low tire pressure, when pushing through curve walked up on built up ice and snow causing one set of trucks on track mobile to derail.	Minor
One set of wheels on rail car derailed when pushing into Richie lead in Abbotsford.	Minor
A bad order rail car with a hole in the bottom of the coal car caused coal to spill out onto the track. One empty rail car rolled up on the coal and derailed one set of wheels.	Minor

TABLE A1-6: PASSENGER ROPEWAYS INCIDENTS

INCIDENT DATE	INCIDENT RATING	QTY. INJURIES	INJURY DESCRIPTION	INJURY RATING	DAMAGE
4-Feb-2014	Severe	0	NA	NA	Damage was limited to one passenger carrier, the sheave assembly at tower 7 and the haul rope.
1-Mar-2014	Severe	4	Injuries requiring hospitalization/ hospital treatment	Major	Five carriers, haul rope, tower sheave assembly components damaged.
11-Jan-2014	Major	0	NA	NA	Eleven carriers damaged; one grip damaged. Lead-in four-sheave assembly pin hole in main assembly elongated from Tower #11 uphill side (may not be related to incident, possibly previous wear).
17 Mar 2014	Major	1	One 4cm laceration, smaller lacerations, bruising	Minor	None
2-Jan-2014	Minor	0	NA	NA	None
3-Jan-2014	Minor	1	Knee injury	Minor	None
3-Jan-2014	Minor	1	Chipped tooth	Minor	None
3-Jan-2014	Minor	1	Possible fractured arm	Major	None
4-Jan-2014	Minor	0	NA	NA	None
9-Jan-2014	Minor	0	NA	NA	None
11-Jan-2014	Minor	1	Pain	Minor	None
13-Jan-2014	Minor	1	Upper arm strain	Minor	None
15-Jan-2014	Minor	1	Pain	Minor	None
15-Jan-2014	Minor	1	Possible head injury	Major	None
18-Jan-2014	Minor	1	Pain	Minor	None
18-Jan-2014	Minor	1	Pain in neck, Possible head injury	Major	None
19-Jan-2014	Minor	1	Neck, back pain; long-term injuries unknown	Major	None
20 Jan 2014	Minor	0	NA	NA	None
25-Jan-2014	Minor	1	Lacerations, bruising, Possible concussion or head or spine injuries	Major	None

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
An unoccupied gondola carrier travelling downhill became detached from the rope and fell to ground.	Wind speeds that occurred on the day of the incident exceeded 70 km/h, and at the time of the incident, a wind gust was recorded at the tower 8 wind meter at 75.6 km/h. The passenger cabin involved was empty and therefore its geometry was more susceptible to the influence of wind loading. Although other gondola passenger ropeway installations have been known to run safely under restricted operational procedures at the wind speeds experienced that day, it is only from operational experience where these procedures can be established. Since this is the first installation of its kind in this specific geographic location with no other passenger ropeways operating in the vicinity, increased caution is required under these weather conditions to gain knowledge on how to operate safely. The person responsible for conducting the line check from inside a cabin lacked experience in the operation of passenger ropeways. This person was trained to be a passenger ropeway operator, but he lacked the knowledge to properly convey what he was observing on the line. All areas of the passenger ropeway alignment exposed to wind were not being monitored during an infrequent wind event that already prompted the operator to operate at reduced speeds. In this instance, posting persons to monitor the ropeway in locations that could not be seen from drive or return station vantage points would have provided better data to make informed decisions about operations that day and in the future. Access to these tower locations is difficult, but monitoring these areas when there are unknowns is critical to understanding the affects of wind. Operations should have been ceased until better data was obtained.
A full deropement of a fixed-grip double chairlift occurred. Three carriers (chairs) fell, two of the chairs carrying passengers.	An empty swinging chair struck a tower, causing a full deropement. The incident was primarily caused by inadequate tension in the haul rope.
Towers #11 and #12 on the up-hill side deroped and several carriers were damaged when the chairs and haul rope hit the ground. Towers #11 and 12 on the down-hill side deroped but the haul rope was retained by the rope catchers. The incident occurred prior to operation for public. Freezing rain caused large ice lobes to accumulate under the sheaves on towers #11 and #12. When the lift was started in the morning these ice lobes caused the haul rope to bounce and slide off of the sheaves.	Freezing rain caused large ice lobes to accumulate under the sheaves on towers #11 and #12. When the lift was started in the morning these ice lobes caused the haul rope to bounce and slide off of the sheaves.
An employee (maintenance worker) was performing maintenance and noticed a spare V-belt hanging close to a rotating shaft and pulley. The employee reached between two safety guards while the lift was running and his hand was pinched between the pulley and drive belt.	Maintenance staff did not shut down and lock out the chairlift before putting his hand between machinery guards towards rotating machinery.
Passengers were evacuated from a chair lift due to a blown electrical fuse in the high voltage distribution electrical supply to the ropeway.	Blown electrical fuse in the high voltage distribution electrical supply
A passenger was hit by a carrier and was dragged by the carrier as the ropeway came to a stop.	The passenger fell while loading.
A passenger fell while riding the T-bar. The passenger was hit in the face by the T-seat when he fell.	The passenger fell while riding the carrier.
Fall from carrier after loading outside the load area (head trap area).	A passenger had loaded an above surface ropeway, during the loading the passenger was crowded and squeezed off the chair by the passenger who was sitting next to them. The passengers were not seated properly when the carrier left the loading point and they fell off the seat.
Two passengers were riding a carrier. One passenger fell approximately 21' onto the snow surface below.	The restraining device was raised before tower 10 and a passenger leaned forward.
Deropement; haul rope retained by the rope catchers.	A passenger approaching the unload station turned his snowboard sideways in a "snow plow" maneuver which added extra tension on the platter he was riding. The passenger then exited the unload area to his right (facing up the line) while still in this "snow plow" fashion. The passenger released the platter and it entered the bull wheel not fully retracted and swinging. The residual energy from the improper release of the platter caused the platter to possibly contact guides on the downhill guide sheave assembly and deroped the assembly.
A passenger fell while attempting to load a carrier with a child.	An adult passenger attempted to load a carrier with a child. The child's ski pole was placed in the seat location where the adult female passenger was intending to load. In the attempt to remove the ski pole from the intended seat before getting seated the passenger ended up being pushed of the end of the load ramp, falling in to the dish area. Because the carrier seating positions was obstructed by a ski pole, the passenger was unable to seat themselves properly with a resulting fall. The lack of attention and/or experience by the child that placed the ski pole in the seat position would be considered a cause of this incident.
A passenger (ski instructor) fell while unloading from the carrier with two school children.	The passenger's skis became tangled while unloading from carrier.
A passenger fell due to misload.	Because his pole became stuck as he was moving through the inside lane loading gate, the passenger was delayed in getting to the loading point. He was then bumped by the carrier, causing him to fall.
A passenger fell from the carrier at the end of the terminal.	After being loaded on carrier child was nudged from carrier by other passenger and fell from carrier (approximately 1.5 to 2 meters).
A passenger riding a secondary carrier was flipped out of his tube at the unload point.	The tube was able to slide over top of the haul rope due to inadequate snow maintenance at the transition point where the tether releases the haul rope.
While attempting to avoid a passenger who fell on the unload ramp, another passenger fell and was struck by the carrier.	A child falling on the unload ramp because they did not raise their ski tips caused a chain reaction in which multiple passengers collided with each other and caused the resultant fall and injuries to one passenger.
A passenger fell of the T-seat approximately four metres before the unload point. The passenger then slid down the track and collided with other passengers.	The passenger who fell may have been advised by lift operator at load not to ride T because of his ability and this lack of skill may have caused him to fall.
A carrier grip loosened and the carrier slid back into the next spring box.	A carrier grip loosened and the carrier slid down the haul rope into the next carrier due to insufficient force (torque) applied to the bolt. The thrust hex screw had loosened off and the snap ring was not correctly seated.
A passenger fell from a carrier prior to unloading and then fell off the structure (approximately five metres to the ground).	It was reported that a passenger was leaning forward with the safety bar in the raised position and slipped out of the seat when her board made contact with the board of the adjacent passenger.

TABLE A1-6: PASSENGER ROPEWAYS INCIDENTS

INCIDENT DATE	INCIDENT RATING	QTY. INJURIES	INJURY DESCRIPTION	INJURY RATING	DAMAGE
28-Jan-2014	Minor	1	Possible neck or spine injury	Major	Tension spring broken
30-Jan-2014	Minor	0	NA	NA	None
31-Jan-2014	Minor	1	Knee pain	Minor	None
1-Feb-2014	Minor	1	Dislocated shoulder	Major	None
1-Feb-2014	Minor	1	Lower leg injury (pain, deformation, swelling)	Major	None
1-Feb-2014	Minor	1	Swollen thumb	Minor	None
2-Feb-2014	Minor	0	NA	NA	Two sheave assemblies bent; 2 rope guards bent; scuffing on haul rope; possible damage to grip.
2-Feb-2014	Minor	1	Pain	Minor	None
6-Feb-2014	Minor	1	Pain, Soreness	Minor	None
8-Feb-2014	Minor	0	NA	NA	None
8-Feb-2014	Minor	0	NA	NA	None
10-Feb-2014	Minor	0	NA	NA	Restraining device on carrier damaged.
16-Feb-2014	Minor	0	NA	NA	None
16-Feb-2014	Minor	1	Possible fracture, pain	Major	None
16-Feb-2014	Minor	1	Bruising, pain	Minor	None
17-Feb-2014	Minor	0	NA	NA	None
17-Feb-2014	Minor	0	NA	NA	None
18-Feb-2014	Minor	1	Possible fracture	Major	None
21-Feb-2014	Minor	2	1 - fractured shoulder; 1 - bruising	1 - Major, 1 - Minor	None
22-Feb-2014	Minor	0	NA	NA	Top side of drive bull wheel damaged.
22-Feb-2014	Minor	0	NA	NA	None
23-Feb-2014	Minor	0	NA	NA	Scuffing to sheave wheel side plate
24-Feb-2014	Minor	1	Extent of injury unknown	Minor	None
26-Feb-2014	Minor	1	Shoulder dislocated	Major	None
26-Feb-2014	Minor	1	Pain (sent to hospital)	Major	None
26-Feb-2014	Minor	0	NA	NA	None
26-Feb-2014	Minor	1	Knee injury	Minor	None

Appendix A1

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
A passenger fell while unloading from a carrier. The restraining device fell back down as passenger was unloading, the bar caught on passengers neck and caused them to fall.	The restraining device fell as the passenger was unloading. The bar caught the passenger's neck and caused him to fall.
A passenger attempting to unload from the carrier fell from the backside of the loading ramp.	Either the child was not adequately familiarized with the unloading manoeuvre or lacked the motor coordination skills to perform the unloading manoeuvre.
A passenger fell while unloading from the carrier.	Passenger was late in unloading themselves from the carrier at the unloading point.
A passenger fell at the unloading point. As she was unloading from the chair, the passenger became entangled with another passenger's ski equipment and fell.	The passenger was tripped by the other loading passenger's ski equipment.
While unloading an above surface ropeway, a passenger caught her ski on her pole and fell in a twisting motion.	The passenger was tripped by his own ski pole which caused a twisting motion as they fell.
A passenger (child), riding a carrier with his parent, fell from the carrier prior to the unload point.	Lack of attention by the passenger and his parent.
Deropement of Tower #1 up-hill sheave assembly.	The passengers skiing outside of the tow path caused a force on the haul rope to pull the rope off of the uphill side sheave assembly. The resultant bounce caused the load area guide sheave assembly on the uphill side to also derope.
After a failed attempt to rescue a passenger hanging from the carrier, the passenger fell from the carrier at the tower #1 location.	The passenger may not have kept herself properly seated after loading the carrier correctly.
A passenger was hit by chair while moving to the load-point.	Passenger was late loading chair.
Two passengers fell after loading the T-bar. The passengers became entangled in the carrier. After releasing themselves from the carrier, the carrier became entangled with a plastic delineation fence pole and the resulting tension pulled the haul rope off the up hill side Tower #1 sheave assembly.	The lift operator did not stop the lift when guests fell. Operator was not monitoring the lift line when the "T" became entangled with delineation fencing. Delineation fence was set too close to the tow path. Rope twist and Tower #1 up-hill side is a contributing factor.
Two gondola cabins collided on a restart of ropeway.	Anti-collision system was bypassed by operator at the time of collision.
A carrier component (foot rest part of restraining bar) contacted the sheave assembly console mounting plate.	Carrier going uphill was pushed back by high winds and footrest part of restraining bar came in contact with sheave assembly console mounting plate. The lift was in process of being closed due to high winds. At the time of incident, a gust of wind was recorded at 64kmph.
A passenger fell from the carrier prior to the unload point.	A passenger, riding with his 4-year-old child, was preparing to unload. The child slid too far forward and slipped out of the carrier as the passenger was raising the restraining bar prior to the unload point.
Two passengers collided and fell at the unloading point.	A passenger (skier) lost his balance after unloading from the carrier.
A passenger (P1) fell while attempting to load onto a chair. Another passenger (P2) attempted to pull passenger P1 back onto the chair, this resulted in the passenger falling beyond the load point.	Misload; Passenger P1 fell because her ski tips had crossed.
A carrier seat pivot sheared off, which let the seat drop down and trip the safety gate on an above surface ropeway. No passengers were loaded on the carrier.	Fatigue of the pivot pin.
The handle tow haul rope splice failed as it was going around the top bull wheel.	Failure of the mechanical haul rope splice.
A passenger fell on the ramp after unloading.	The passenger (skier) lost control while exiting the unload ramp after he unloaded an above-surface ropeway.
Deropement of Tower #1 uphill side sheave assembly. The haul rope fell and contacted two passengers, resulting in injuries.	A passenger riding the ropeway may have initiated the deropement by causing a side load to the haul rope (by skiing or riding the lift outside of the towpath). However, it is worth noting work was conducted prior to the incident to address rope-sheave alignment issues at the drive station and tower #1. Based on the operator's report, it can be assumed that poor rope/ sheave alignment, worn sheave liners were a contributing factor to the deropement. The report also indicated that the tensioning system was not functioning as per design, which may also have contributed to the deropement.
A grinding sound was observed by a lift operator and the ropeway was stopped.	Failure of bull wheel keeper bolt on gearbox output shaft allowed bull wheel to move up output shaft and rub on station frame/bolts. Possibly caused by repeated impacts from carriers hitting the swing ring when entering the bull wheel.
Deropement of downhill side of top station bull wheel guide sheaves.	A passenger did not unload correctly and pull T to the left, causing the T to slingshot and the carrier to swing exiting the bull wheel. This caused the Haul rope to leave the sheaves and trip the deropement safety switch. This ropeway is a bull wheel unload-style station and passengers mostly go to the left when unloading.
The haul rope deroped from the incoming two-wheel station sheave assembly. A passenger (snowboarder) pushed away from the carrier (aggressive lateral push) as he was unloading, causing the haul rope to move out of the sheave wheel grove and over the side plate.	The lateral forces caused by a passenger using excessive force to remove himself from the carrier seat caused the haul rope to move out of the sheave wheel groove and over the side plate.
A gondola stopped during operations. Lift operations attempted to restart the ropeway and ran a loaded cabin into a stalled cabin.	The gondola stopped due to a counter fault (grip was under a flat tire). The lift operator did not closely watch cabins when running ropeway with an anti-collision system bypassed and allowed two cabins to collide.
A passenger was injured while unloading from the carrier.	The passenger (snowboarder) used his arm/hand on the chair to steady himself and dislocated his shoulder while disembarking from the chair at the unload point.
A passenger fell on the unload ramp.	The passenger (skier) lost control and fell after unloading.
A manufacturer's technician plugged in a computer and caused a fault, resulting in a manual evacuation.	The chair lift was in the process of shutting down for the day. During a routine chairlift inspection, a manufacturer's technician plugged in a computer and interfaced with the ropeway while the ropeway was operating and caused a fault that did not allow the chair to run. The technician was not supposed to interface with the ropeway system until the lift was closed for public operation.
A passenger fell while unloading an above surface ropeway.	A passenger was unloading an above surface ropeway when his ski pole became stuck on the carrier. The passenger was trying to disengage his stuck pole from the chair seat. When he pulled on the pole, it caused them to fall.

TABLE A1-6: PASSENGER ROPEWAYS INCIDENTS

INCIDENT DATE	INCIDENT RATING	QTY. INJURIES	INJURY DESCRIPTION	INJURY RATING	DAMAGE
27-Feb-2014	Minor	1	Suspected fracture	Major	None
27-Feb-2014	Minor	1	Pain	Minor	None
27-Feb-2014	Minor	0	NA	NA	None
28-Feb-2014	Minor	1	Broken leg	Major	None
1-Mar-2014	Minor	1	Abrasion	Minor	None
2-Mar-2014	Minor	1	Pain	Minor	None
2-Mar-2014	Minor	1	Fractured ankle	Major	None
4-Mar-2014	Minor	1	Separated shoulder	Major	None
6-Mar-2014	Minor	0	NA	NA	None
7-Mar-2014	Minor	1	Pain	Minor	TBD
8-Mar-2014	Minor	1	Sore ribs, bruised arm	Minor	None
11-Mar-2014	Minor	1	Pain	Minor	None
13-Mar-2014	Minor	0	NA	NA	None
15-Mar-2014	Minor	0	NA	NA	None
19-Mar-2014	Minor	1	Ankle injury	Minor	None
19-Mar-2014	Minor	0	NA	NA	Distorted wires in 6 locations, dent in the upper rim of the bull wheel, damage to the T-bar seat, inside rope guard on the uphill side return station guide sheave assembly destroyed.
25-Mar-2014	Minor	1	Sore shoulder	Minor	None
25-Mar-2014	Minor	1	Pinched finger, possible fracture	Major	None
26-Mar-2014	Minor	1	Possible fracture	Major	None
28-Mar-2014	Minor	1	Back pain (sent to hospital)	Major	None
30-Mar-2014	Minor	1	Shoulder injury (sent to hospital)	Major	None
2-Apr-2014	Minor	1	Pain	Minor	None
13-Apr-2014	Minor	0	NA	NA	Broken nylon gear tooth
18-Apr-2014	Minor	1	Swelling, pain, limited mobility	Minor	None
26-Apr-2014	Minor	0	NA	NA	None
18-May-2014	Minor	0	NA	NA	None

Appendix A1

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
At the load point, a passenger attempted to side-step off the loading ramp to allow a carrier to pass by. She was clipped by the passing carrier and fell to the side of the loading ramp.	Passenger side stepping off the loading ramp in an attempt to avoid load... an approaching carrier.
A passenger fell on the ramp after unloading from an above surface ropeway and fell.	The passenger lost control after unloading and were on the unload ramp.
The service brake system malfunctioned; passengers were evacuated from the lift using the evacuation drive.	The service brake system fault did not annunciate on the safety system display. Maintenance staff reported that after lubricating the break thruster seal and readjusting the brake, the lift was operational.
A passenger fell while unloading and above-surface ropeway.	The passenger's (snowboarder's) foot caught on his snowboard, causing him to fall.
A passenger fell from the carrier prior to unload, approximately 6m before the unload point.	The passenger was not following instructional signage and was riding the carrier with the safety bar raised and was leaning forward.
The ropeway was run in reverse to assist a passenger (child) that had slipped from the carrier and was held by his parent. The child did not fall to the ground.	The passenger slipped from the carrier after loading.
A passenger (snowboarder) fell in the lift entrance.	The passenger was entering the maze gates at the loading area of a chairlift. His free foot got caught in the maze panel when the were pushing themselves through the maze which caused a twisting fall resulting in an injury.
A passenger failed to unload properly and was struck by a chair	A passenger did not load properly causing the carrier to swing and hit a fellow passenger who fell onto her shoulder as a result. Three passengers attempted to load the chairlift, the lift operator had stopped them at the loading area in preparation for loading. The three passengers proceeded into the load area and the passenger on the outside (furthest away from the lift center-line) made it to the load area late and too far away from the carrier seat to the outside. The guest became entangled in the chair and pulled the carrier back.
Deropement of downhill assembly tower. Ice accumulation on an above surface ropeway caused the haul rope to run out of its normal running position on the tower sheave during morning start up. The ropeway ran 10 to 15 metres at 10% speed.	Layer of ice caused the rope to roll out (past the low flanged side of the sheaves).
A passenger attempted to ski across the moving conveyor and fell on the conveyor surface.	Guest did not follow warning signs to remove equipment before passing over conveyor. The operation should not have allowed the practice of stepping over a moving conveyor.
A passenger who had fallen out of a carrier at the loading area was struck by a downhill-moving carrier.	The passenger slipped out of the carrier (suspect not properly seated) and fell into the perimeter area. Then stood up, not seeing and unaware of the approaching downhill carrier.
A passenger fell on the ramp while unloading.	The passenger fell while trying to avoid another passenger who had fallen ahead of them.
An electrical fault occurred and could not be cleared. The line was cleared using the evacuation drive.	Electrical fault at return station.
A deropement occurred during morning start up and there were no passengers on the ropeway at the time of the incident. The haul rope was retained by the rope catchers.	High wind caused haul rope to derope, incident occurred during morning start up and there were no passengers on ropeway at time of incident.
A passenger was escorting another passenger who was injured. (The injury was not related to the ropeway). A passenger failed to unload at the designated unload point and fell and sustained an ankle injury.	The passenger riding failed to unload at the designated unload point resulting in the fall. As a contributing factor, the attendants were not advised that the aforementioned passenger was escorting another injured passenger. This could have alerted the attendant/s to either stop of slow the lift for the loading and unloading procedure.
The return station uphill side portal assembly deroped.	A T-bar seat became entangled with a guide sheave assembly. The T-bar seat rope broke and the assembly derailed. The carrier assembly entered the bull wheel at an unusual angle as the lift was stopping and caused the haul rope to leave the bull wheel liner. The haul rope was retained by the carrier guide ring on the bottom of the bull wheel.
A passenger was struck by a carrier.	While attempting to load a chairlift, a passenger dropped his poles at the loading point. The guest dropped his poles and lost his balance while trying to pick them up. Operator initiated a stop but the carrier was too close to the passenger to stop in time and as the passenger stood up, he was struck by the carrier and fell.
As the restraining bar was lowered, a passenger's finger was pinched between the seat frame and the restraining bar.	The passenger was not aware that his finger was in a position of risk to get pinched.
A passenger fell while unloading.	The passenger became entangled with his equipment and another unloading passenger.
A passenger's carrier became entangled with the downhill side carrier. The passenger was raised approximately ten feet off the tow path before falling onto it.	The passenger was skiing out of track between Towers 1 and 2, causing the up-going and down-coming carriers to come into contact with each other.
A passenger fell while unloading from an above-surface ropeway.	The passenger's ski poles became tangled with another passenger while unloading an above surface ropeway. This caused both passengers to fall onto the unloading ramp.
A passenger moving through the loading gate was pushed over by a moving carrier.	The passenger moved through wait gates and into the path of a moving carrier.
Station carrier conveyor system failure. Passengers were evacuated from the ropeway after the drive station (top station) turnaround conveyor section seized.	Broken tooth on a nylon conveyor gear
A passenger was struck by the carrier she was about to load.	The passenger was riding this lift for the first time and was unsure as to the correct loading position. The passenger was hit by the carrier hanger as she was shifting her position.
A tower safety circuit fault caused passengers to be stranded on a ropeway. Passengers were evacuated by use of the evacuation drive.	A loose wire at tower #12 caused a Tower #10 ground fault indication in the tower safety circuit.
During public operations, the DC drive shut down. The ropeway was switched from the main drive to the auxiliary drive.	Cooling fan fuse failure.

Appendix A1 Incident Summaries Continued

TABLE A1-6: PASSENGER ROPEWAYS INCIDENTS

INCIDENT DATE	INCIDENT RATING	QTY. INJURIES	INJURY DESCRIPTION	INJURY RATING	DAMAGE
6-Aug-2014	Minor	0	NA	NA	Emergency brake hydraulic hose damaged.
19-Aug-2014	Minor	1	Dislocated shoulder	Major	None
15-Sep-2014	Minor	0	NA	NA	None
24-Nov-2014	Minor	1	Dislocated hip	Major	None
28-Nov-2014	Minor	0	NA	NA	One spring box hanger damaged.
29-Nov-2014	Minor	0	NA	NA	Passenger cabin and carriage damaged.
9-Dec-2014	Minor	0	NA	NA	None
14-Dec-2014	Minor	1	Pain	Minor	None
31-Dec-2014	Minor	0	NA	NA	None

TABLE A1-7: AMUSEMENT DEVICES INCIDENTS

INCIDENT DATE	INCIDENT RATING	QTY. INJURIES	INJURY DESCRIPTION	INJURY RATING	DAMAGE
19-Apr-2014	Minor	1	Laceration requiring stitches	Minor	None
22-Jun-2014	Minor	0	NA	NA	None
25-Jun-2014	Minor	1	Laceration requiring stitches	Minor	None
14-Jul-2014	Minor	0	NA	NA	Non-structural spalling in the concrete surface.
15-Jul-2014	Minor	1	Laceration requiring stitches	Minor	None
17-Jul-2014	Minor	1	Suspected concussion or whiplash	Major	None
20-Jul-2014	Minor	0	NA	NA	Brake calipers on the passenger car's front truck damaged.
30-Jul-2014	Minor	1	Numbness in arms	Minor	None
2-Aug-2014	Minor	1	Possible fractured arm	Major	None
5-Aug-2014	Minor	1	Possible head injury	Major	None
7-Aug-2014	Minor	1	Pain	Minor	None
7-Aug-2014	Minor	0	NA	NA	Main hoist cable damaged.

Appendix A1

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
Passengers were evacuated from the ropeway using the evacuation drive after the hydraulic hose for the emergency brake failed.	Failure of brake component.
A passenger fell as she was descending the stairs from the bottom station unloading deck.	The passenger lost her footing and stumbled.
Loss of main power required the use of the evacuation drive. An excavator contacted a high voltage line.	Correct work procedures were not followed by staff. The excavator operator was not informed of power lines in the area they were working.
A passenger (skier) fell at the unload station.	While unloading from the carrier, a passenger's ski became entangled with another passenger and fell.
Deropement into rope catcher due to bent empty carrier hanger entering into Tower 2 uphill sheave assembly.	A damaged surface ropeway carrier caused a deropement on a tower sheave assembly. A bent empty carrier hanger entered into the Tower 2 up hill sheave assembly. A passenger (alpine racer) may have been skiing out of the track, which caused contact of the hanger against a sheave assembly and initiated the failure of the hanger head to the hanger weld connection. The sheave-carrier clearance was reduced by the carrier geometry change due to the partial weld failure.
While doing a dry (empty) test run, the operator noticed that the passenger cabin was jerking and swinging as it approached tower 2. The operator pushed the stop button, once cabin had stopped swings drive direction was reversed and the cabin brought uphill to the load platform. Once the cabin was at its correct loading point the operator noticed that the front (downhill) wheels (sheaves) had come of the track ropes.	Intermittent failure of haul winch hydraulic operating system. The failure was caused by the low temperature of the hydraulic oil and components. Weather data gathered indicates that the overnight temperature with wind chill was between -16C and -21C. At the time of the incident a new building was being constructed around the drive winch and drive equipment, the walls had been removed and this would have allowed the wind to blow directly on the drive winch and drive equipment. This additional wind chill would have allowed for the extra cooling of the drive winches hydraulic oil and components.
A carrier's running wheels came out of the rail.	A gust of wind caused an empty carrier to blow back in the terminal. When the carrier swung forward, it contacted the deck, causing the running wheels to pop out of the rail. The incident occurred as the operator was in the process of closing the facility due to high winds.
A passenger (skier) fell on the unload ramp.	While unloading from the centre position of a triple chair, the passenger inadvertently allowed her skis to splay apart, resulting in a fall on the unloading ramp.
The haul rope deroped from the sheave assembly on the downhill side of Tower 3. The haul rope was retained by rope catchers and the ropeway was stopped by the deropement switch.	A T-seat was hooked over the haul rope. The cause of the T-seat being over the haul rope is unknown, it may have occurred after a passenger unloaded and was not noticed by the top station operator and did not trip the safety gate. The T may have been hooked over the rope when a passenger skied out of the track above Tower 3 and the uphill carrier's rope hooked the downhill carriers seat, causing the T-seat to swing over the haul rope.

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
A rider slipped on the ride's aluminum checker plate and fell.	The rider may have slipped while unloading from the passenger car.
Two riders collided on a zip line.	Lack of communication between zip line operators. Rider 1 did not make it to the landing platform because of a strong head wind. The landing platform guide (operator) called to the launch platform guide to communicate this fact and to inform them they were doing a manual retrieval of Rider 1 from the line. The launch platform did not hear the communication clearly and though the landing platform guide said it was clear to launch Rider 2. Rider 2 was launched and because of the strong head wind they did not reach a higher speed, the collision that occurred was at a very slow speed.
While descending the track, the rider's head contacted the track surface.	It was reported that the rider indicated that he did not lean enough into the corner, resulting in his head contacting the upper edge of the track. Instructional signage indicates that riders are to lean into the turn as they descend the track.
Spalling was discovered by staff in concrete track sections at expansion gap areas.	Surface temperatures taken on July 16, 2014 of the concrete track sections ranged from 28C in the shade to 43.5C in the sun. Staff indicated that the air temperature was very similar to that of July 14, 2014. It is assumed that the combination of the deficient concrete surface and the nature and/or location of the material used to fill expansion gaps (to allow for a smooth transition between track sections for the summer operation of the wheeled sleighs) did not provide enough flexibility to prevent concrete from spalling due to thermal expansion.
A rider entered the landing pool and struck his knee on the bottom of the pool.	The rider lost correct riding position coming down the slide. He entered the landing pool feet first on his stomach (prone). The correct landing position is on the back feet first (supine).
A rider fell out of the inner tube while on a tube slide.	The rider did not maintain her position on the tube resulting in her falling off the tube and sliding onto the pool.
Prior to the last track joint in the curve, the front wheels of the passenger car behind the locomotive derailed.	Train gauge was 1/8" under tolerance at derailment point. Track spikes loose in this area. Splice joint tie was not properly supported and able to flex at this point. Inexperienced operator.
Two riders loaded a raft on a water slide. When the raft reached the bottom of the decline and was rising into the incline of the other side of the ride, one rider swung her head back but her head did not contact the slide. After the raft came to a rest at the bottom of the slide, the rider reported numbness.	All accounts report that the guests were in proper riding position during the ride. The rider has a medical condition that could have contributed to the numbness experienced.
A rider reported he was injured when exiting the ride.	There were no witnesses of the incident. The attendant that was unclipping seats as trained did not see the event occur. The rider was of appropriate size to ride the device, rider error upon exiting the seat is the suspected cause of the incident.
A rider was riding a raft water slide on her stomach. At the bottom pool, the rider's tube flipped and reported that she hit her head.	The rider was not in the correct riding position. The first aid attendant learned that the rider suffered from a medical condition that may have contributed.
While unloading from the carousel, a rider fell backwards from the carousel platform (deck) and hit the ground with her back.	
A ride's hoist cable became jammed in the guide pulley as the ride was nearing the top of the tower. The hoist winch shut down on overload. The jammed cable could not be moved and the ride was evacuated.	It appeared that the operator was operating on manual mode before incident occurred and when they switched back to auto mode the cable became jammed, hoist cable may have come out of alignment while operating in manual mode.

TABLE A1-7: AMUSEMENT DEVICES INCIDENTS

INCIDENT DATE	INCIDENT RATING	QTY. INJURED	INJURY DESCRIPTION	INJURY RATING	DAMAGE
9-Aug-2014	Minor	1	Lost consciousness; Hip injury	Major	None
21-Aug-2014	Minor	1	Pain, scrapes/abrasions	Minor	None
27-Aug-2014	Minor	1	Suspected soft tissue and bone contusion	Minor	None
28-Aug-2014	Minor	0	NA	NA	None
23-Oct-2014	Minor	0	NA	NA	None

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
A rider attempted to help her granddaughter off the carousel. The rider misjudged the step off the ride and fell on her hip.	The rider misjudged the step off the ride.
Two riders were descending the track through corner #5 when one rider applied the manual brake. At the point, the cart was reported to have slid sideways and flip, causing the riders to become separated from the cart.	Riders entered corner 5 did not provide enough lean and/or braking
A rider stepped onto an unsupported corner of the ride's moving deck. The rider's leg fell through the unsupported corner.	A catwalk plate was not installed correctly during the ride set up. Normal assembly of the catwalk plates require the 2' x 5' diamond plate be supported underneath by 1 1/2' angle iron at each end of the plate. The angle iron has four vertically-welded dowels which go into holes that are drilled into a box tube frame which is welded to the catwalk plate. This secures the plate into position. Each plate end has two holes at each end (for a total of four). Each horizontal angle iron supports two adjacent plates, so each plate has 3/4' of support underneath each of its ends. In the case of this incident the catwalk plate was laid down into position but only had one of the vertical dowels securing it and left it unsupported by the angle iron because of misalignment. This misalignment allowed the plate to veer off the support of the angle iron. The adjacent plate was put into position, the box frame hole was put onto the position of where the previous plate was to be placed. This error is hard to recognize when inspecting as it looks normal from the top and would be hard to see from the underside.
Two riders boarded the ride's #1 car with two bags (one backpack, one handbag) and a camera mounted on an extendible pole. During the ride cycle, the riders' carrier lap bar inadvertently opened.	Inspection revealed that a step had word into the rolling portion of the lap bar bottom ends (wear was due to repeated articulation of the safety bar and would be considered normal wear). It was demonstrated that a false lock condition could occur making it appear to the operator that the safety bar is latched when conducting a pull test. Instructional signage indicates that no loose items are to be taken on board the ride and specifically mentions "no back packs." Based on reports from the operator, it appeared common practice for operators not to enforce this policy. It is further theorized that items (back pack and bag) that were carried by the passengers and placed on the floor of the carrier may have interfered with the lap bar mechanism by preventing an effective push pull test of the lap bar. That is, that these items my have prevented the bar from being pushed all the way forward (by the operator in conducting a push and pull test of the safety bar) and allowing a false lock condition to occur.
After descending the water slide, riders slid the entire length of the discharge lane and made contact with the discharge lane end.	Upon inspection by a manufacturer's representative, it was noted that the water level in the discharge lane was lower then the manufacturer's recommended depth markings (depth is based on tests conducted during commissioning and levels were marked at that time). It is theorized, by the manufacturer, that a reduction of the pump volume rate, at the early run in period, caused a significant drop in the water level of the discharge lane (this is considered normal wear). The manufacturer indicated that changes in flow rate can be most readily noticed by changes in water level in the discharge lane (flow meter reading may not change significantly enough to be realized by the observer). The operating staff were not aware of the drop in the discharge lane water level. The operator has indicated, that discharge lane water level was not part of the daily check-sheet (Operations and Maintenance Manual indicates verifying correct water level is part of the daily inspection requirements). The operating contractor had indicated that the attendants were aware of the importance of checking water level during operation but were not consistent with each other into determining where the water level marking were to be observed from (above or below line).

Appendix A2 Ammonia Release Incidents (2007-2013)

TABLE A2-1: SUMMARY OF AMMONIA RELEASE INCIDENT INVESTIGATIONS (2007-2013)

INCIDENT DATE	CAUSE CATEGORY	QTY. INJURIES	INJURY DESCRIPTION	OCCUPANCY (FACILITY USAGE)
12-Jun-2008	Not recorded	1	Ammonia exposure	Arena
5-Mar-2010	Equipment failure	0	NA	Arena
11-Apr-2010	Not recorded	0	NA	Arena
17-Jul-2010	Equipment failure	0	NA	Food processing/ production
21-Oct-2010	Equipment failure	1	Ammonia exposure	Arena
11-Nov-2010	Operation - oil transfer	0	NA	Arena
23-Nov-2010	Weather	0	NA	Arena
27-Oct-2011	Equipment failure	0	NA	Food processing/ production
12-Nov-2011	Equipment failure	0	NA	Food processing/ production
28-Nov-2011	Equipment failure	3	Ammonia exposure	Arena
30-Nov-2011	Equipment failure	0	NA	Arena
28-Feb-2012	Equipment failure	0	NA	Food processing/ production
20-Jul-2012	Equipment failure	0	NA	Food processing/ production
12-Sep-2012	Installation	0	NA	Arena
4-Nov-2012	Installation	0	NA	Food processing/ production
18-Jan-2013	Operation - refrigerant transfer	0	NA	Arena
6-Mar-2013	Equipment failure	0	NA	Food processing/ production
15-May-2013	Equipment failure	19	Ammonia exposure	Food processing/ production

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
Accidental discharge of 200kg ammonia.	Not recorded
Approximately 45 to 50 lbs ammonia was released. The facility "lost a condenser pump as it tripped out on high amps." A pressure relief valve opened and released the ammonia gas through the emergency discharge line.	Not recorded
Brine chiller tube leak which allowed high pressure ammonia to leak into the low pressure brine system.	Not recorded
Ammonia refrigerant entered a 'chill room' at an industrial facility. Corrosion to a 3/8-inch to a 1/4-inch forged steel bushing allowed it to split open and release ammonia.	By design, the bushing had only a small amount of material available to resist pressure. 3/8- to 1/4-inch bushing has threads cut inside and outside to allow use as bushing and when external corrosion worked at the bottom of the outside threads to reduce the already small amount of material (less than 1/8 inch). The working pressure of the ammonia on the low side split open the strainer bushing with the strainer drain valve still attached. Avoiding use of forged steel bushings on the initial installation with thin side walls and also where exposure or corrosion is a possibility.
An ammonia leak occurred in the machinery room of a community ice arena. A pressure relief valve located on the condenser tower of the heat recovery system opened.	The plant operator and refrigeration contractor found the condenser motor did not start. With the failure of the condenser motor, the system temperature increased and the pressure rose to its limit (where the pressure relief valve opened). With the failure of the motor, an increase in system temperature and corresponding pressure resulted and rose to the point of causing the pressure relief valve to open. Each compressor is fitted with a high pressure limit that should have opened the circuit to the compressor, before getting to the point of relieving through the pressure relief valve. This did not occur as this safety device failed to operate. As recently as July/August of 2010, they were tested and all but two of the safety switches were replaced. This is one of the two that tested ok.
An ammonia leak occurred in the machinery room of an unoccupied arena. An employee was attempting to add oil to an ammonia compressor when he observed a leak (fill hose was not attached). Approximately 200 lbs ammonia was released.	Qualified person was trained, but with minimal experience in this procedure. No written procedure was available, and an error occurred while executing the procedure. The shut-off valve type (wrench-operated, multi-turn, no position indicator) added complexities to the process.
Ammonia was released at a recreational facility. A high pressure cut out switch failed to shut down a compressor when the compressor experienced a high pressure condition. Pressure continued to build until a safety relief device operated releasing ammonia gas to atmosphere via the relief stack, which triggered the ammonia alarm.	The water supply line to an evaporative type condenser had frozen due to outside weather conditions, cutting-off cooling water to the equipment. The water supply line to the condenser had no protection and was subject to freezing during cold weather. A high-pressure cut-out switch failed to shut down one of the compressors and as a result, a high pressure condition was created. One of four high limit switches failed to shut down its compressor. The high limit switch was old (1986) and is mounted on the compressor base subjecting it to vibration.
Employees at an industrial premise observed a leak from the freezer's evaporator coil.	Corrosion to steel bushing allowed the ammonia to leak in the mechanical room housing the evaporator coils.
An ammonia leak occurred at a commercial-industrial facility. Approximately 10 lbs ammonia entrained in approximately 200 litres of compressor oil was released when a suction side 3/8-inch pressure sensing line failed. The suction side oil pressure pushed approximately 200 litres of oil from the reservoir onto the floor where the entrained ammonia then escaped to atmosphere.	The 3/8-inch stainless steel tubing within the compression fitting failed when a circumferential crack completely fractured. The crack within the 3/8-inch stainless steel compression fitting did not show up on external inspection. Metal fatigue appeared to be a factor, along with unit vibration and initial metal stress within this type of compression joint.
Approximately 400lbs ammonia refrigerant was released to the atmosphere from a safety valve on the outdoor refrigerant condenser. At shift change, an uncertified operator was made aware that two ammonia refrigeration compressors had been short-cycling from 0400 Hrs (low suction pressure). The operator then opened the suction by-pass valve to a second chiller. Both ammonia compressors started then quickly tripped. The operator reset both high pressure limits. This process was repeated. The ammonia condenser safety valve lifted, and when the operators walked outside to investigate, they both walked into ammonia vapor. A third compressor continued to cycle and lift the safety valve for one hour (400 lbs of ammonia released).	Condenser pump controller (Johnson Controls/Penn P70AA-119, J0019, range 50/300 psig, opens low) fails after 6 months of service, causing condenser pump to run continuously. Condenser is subject to adverse ambient conditions (freezing temp/high relative humidity) which causes: 1) ice to deposit on fan blades (tripping fan vsd (sic) on overload), and 2) ammonia migration from HP receiver to condenser (where liquid accumulates in the tubes and restricts hot gas flow, resulting in high back pressure at compressors), and 3) ammonia migration from chiller to high pressure receiver (resulting in low suction pressure at the compressors). Condenser safety valve appears to lift prematurely (less than 250 psi) and does not reset. Operator error due to lack of training and knowledge also contributed.
Approximately 300lbs ammonia was released when two maintenance contractors attempted to transfer ammonia from a liquid receiver to a storage bottle. While attempting to purge the transfer hose, the ratchet wrench on the isolation valve failed to operate in the reverse direction. The maintenance contractor inadvertently opened the valve wider, allowing the release of ammonia.	The primary cause of the release was due to a ratchet wrench which failed to operate correctly (i.e., in the opposite direction).
Approximately 75lbs liquid ammonia was released into the machinery room at an industrial facility when a gasket failed on the cap of a liquid level controller for a refrigeration vessel.	Examination of the cap on the liquid level control revealed impact damage. This damage is the result of the occasional physical removal of ice. Over time the cap loosened causing liquid ammonia to leak by the cap gasket. The initial attempt to tighten the cap resulted in fracturing the fibre gasket. Incorrect procedures, inadequate staff training and poor quality control also contributed. Some written procedures and emergency instructions were in place but not entirely followed.
An ammonia leak occurred at a commercial facility. The leak occurred at the compressor and was isolated by the shut-off valves.	Normal wear and usage on the compressor was observed where the mechanical seal failed.
At a recreational facility, the ammonia LED sensor display indicated 7ppm. An ammonia leak was detected and isolated to the compressor #2 suction valve.	It was reported to the safety officer that the contractor installed the suction valve without securing (tightening) the valve bonnet. In addition, the bolts may not be to specification and may not have been threaded to depth properly at the flange connections to the associated valve piping.
Approximately 100lbs ammonia was released into an unoccupied processing room of an industrial facility when a pressure gauge failed on the liquid line to an ammonia evaporator.	Inspection revealed that a second pressure gauge (on the hot gas line for the same installation) was pinned at maximum pressure. Both pressure gauges had a range of 0 to 150psi and were installed in a system with an operating pressure of 150 to 160psi. The pressure gauge failed from over-pressure operation.
The recreational facility's ammonia alarm sounded when the ammonia concentration was detected at 25ppm. Operators were in the process of topping up the ammonia charge from a portable tank. When threading the flexible hose into the charge line, the port on the valve discharged ammonia and blew the flexible hose away from the fill valve.	The fill line was already open when an operator attempted to connect the portable tank's flexible hose. Because the line was open, when the operator was threading the flexible hose onto the charge line, the port valve discharged ammonia and blew the flexible hose away.
The shift engineer observed that the ammonia leak monitor was in alarm (>35ppm). When the shift engineer activated the control system reset, the system failed. With no condenser fans or pumps in service, the high pressure discharge quickly exceeded the relief valve settings and two relief valves were activated, resulting in approximately 500lbs ammonia released to atmosphere.	"High Liquid Level" in the Low Temp Suction Accumulator (for Frick #1) shuts down all plant equipment (in the main compressor room) via the "control system" (this also shuts down the evaporative condenser fans and water pumps). Frick #2 (in auto control) starts up on local controller call (during the plant "trip"). With no condenser fans or pumps in-service, the high pressure discharge quickly exceeds relief valve settings (250 psi) and two relief valves are activated (one does not reseat). The 1970 vintage plant has had at least two upgrades, and a subsequent investigation identifies control system deficiencies. Lack of knowledge and inadequate staff training contributed.
Approximately 200 lbs ammonia was released to the atmosphere from a refrigeration system at an industrial facility when a compressor controller and control system failed. Two of the eight condenser relief valves were activated.	High Liquid Level (in the Low Temp Suction Accumulator) initiated a shutdown of all plant equipment via the plant control system. However, during the investigation it was discovered that the plant control system does not shut down the Frick #2 compressor, and the NH3 liquid pumps, which are associated with the remote "High Temp Air Chill System". Frick #2 compressor continued to run and, with no condenser fans or water pumps in-service, the condenser pressure quickly exceeded relief valve settings (250 psig). Poor quality control, inadequate staff training and lack of knowledge also contributed.

Appendix A2 Ammonia Release Incidents (2007-2013) Continued

FIGURE A2-1: AMMONIA RELEASE INCIDENTS REPORTED TO BC SAFETY AUTHORITY 2007-2013

FIGURE A2-2:
AMMONIA REFRIGERATION UNITS – SOUTHERN BC

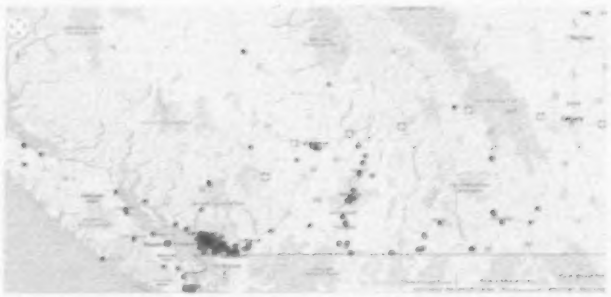


FIGURE A2-3: AMMONIA REFRIGERATION UNITS –
LOWER MAINLAND AND SOUTHERN VANCOUVER ISLAND

Appendix A2

FIGURE A2-4:
AMMONIA REFRIGERATION UNITS - LOWER MAINLAND

FIGURE A2-5:
AMMONIA REFRIGERATION UNITS - NORTHERN VANCOUVER ISLAND

FIGURE A2-6:
AMMONIA REFRIGERATION UNITS OKANAGAN VALLEY

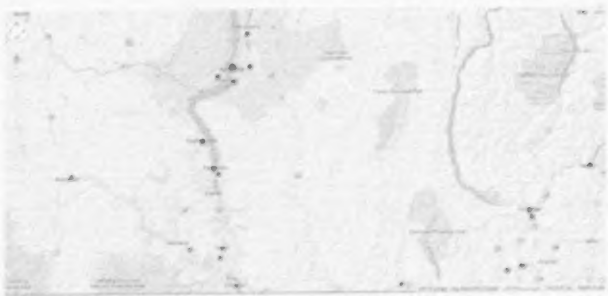


FIGURE A2-7:
AMMONIA REFRIGERATION UNITS - CENTRAL-NORTHERN BC

Appendix A3 Deropement Incidents (January 2009 – June 2014)

TABLE A3-1: SUMMARY OF FACTORS CONTRIBUTING TO DEROPEMENT INCIDENTS ON AERIAL ROPEWAYS

CAUSE	CONTRIBUTING FACTOR	Qty	DESCRIPTION
Sideways forces or sudden forces applied to the cable	Passenger usage	5	Passenger unloading error
	Weather	2	High and/or strong winds
	Excessive carrier swing	1	Swinging carrier contacted tower
		1	Operator contacted carrier when removing snow
Contamination on cable	Weather	2	Ice accumulation
Equipment	Alignment	1	Poor sheave assembly alignment
Operational error	Lack of experience	1	Operators lacked operational experience at the installation location.

TABLE A3-2: SUMMARY OF FACTORS CONTRIBUTING TO DEROPEMENT INCIDENTS ON SURFACE ROPEWAYS

CAUSE	CONTRIBUTING FACTOR	Qty	DESCRIPTION
Sideways forces or sudden forces applied to the cable	Passenger usage	19	Passenger skiing or snowboarding out of the tow path
		14	Passenger loading or unloading error
		6	Passenger fell on tow path
		1	Passenger swerved
	Excessive carrier swing	3	Swinging carrier during operation
		2	Irregular or uncontrolled carrier retraction
		1	Excessive swing on ropeway start-up
	Weather	1	High/strong winds
Equipment	Component failure	1	Sheave assembly component failed
	Installation	1	Spring box installed backwards after servicing
Contamination on cable	Weather	1	Ice accumulation

TABLE A3-3: SUMMARY OF FACTORS CONTRIBUTING TO RETAINED DEROPEMENT INCIDENTS

CAUSE	CONTRIBUTING FACTOR	Qty	DESCRIPTION
Sideways forces or sudden forces applied to the cable	Passenger usage	12	Passenger loading or unloading error
		9	Passenger skiing or snowboarding out of the tow path
		1	Passenger fell on tow path
	Excessive carrier swing	3	Swinging carrier during operation
		2	Irregular or uncontrolled carrier retraction
		1	Excessive swing on ropeway start-up
		1	Operator contacted carrier
	Weather	3	High and/or strong winds
Contamination on cable	Weather	2	Ice accumulation
Equipment	Alignment	1	Poor sheave assembly alignment
	Component failure	1	Sheave assembly component failed

TABLE A3-4: SUMMARY OF FACTORS CONTRIBUTING TO NOT-RETAINED DEROPEMENT INCIDENTS

CAUSE	CONTRIBUTING FACTOR	Qty	DESCRIPTION
Sideways forces or sudden forces applied to the cable	Passenger usage	10	Passenger skiing or snowboarding out of the tow path
		7	Passenger unloading error
		5	Passenger fell on tow path
		1	Passenger swerved
	Excessive carrier swing	1	Swinging carrier contacted tower
Contamination on cable	Weather	1	Ice accumulation
Equipment	Installation	1	Spring box installed backwards after servicing
Operational error	Lack of experience	1	Operators lacked operational experience at the installation location.

Appendix A3 Deropement Incidents (January 2009 – June 2014) Continued

TABLE A3-5: SUMMARY OF DEROPEMENT INCIDENT INVESTIGATIONS

YEAR	CAUSE CATEGORY	QTY. INJURIES	INJURY DESCRIPTION	DEROPEMENT TYPE	DAMAGE	ROPEWAY TYPE	INSTALLATION AGE
2009	Passenger unloading error	0	NA	Not retained	T damaged; complete carrier removed from service.	Surface	31
2009	Passengers riding out of tow path	1	Broken clavicle, concussion	Not retained	Carrier was twisted and removed from service.	Surface	44
2009	Passenger riding out of tow path	0	NA	Not retained	None	Surface	15
2009	Passenger riding out of tow path	0	NA	Retained	None	Surface	18
2009	Fall on tow path	0	NA	Retained	None	Surface	15
2010	Passenger unloading error	0	NA	Retained	None	Surface	15
2010	Sheave assembly alignment	0	NA	Retained	Severed communications line	Aerial	21
2010	Fall on tow path	1	Abrasion, arm swollen	Not retained	Sheave damaged; T-seat damaged	Surface	35
2010	Passenger unloading error	0	NA	Retained	None	Surface	30
2010	Passenger unloading error	0	NA	Retained	None	Aerial	48
2010	Passenger riding out of tow path	0	NA	Not retained	None	Surface	39
2010	Passenger unloading error	0	NA	Retained	None	Aerial	48
2010	Irregular carrier retraction	0	NA	Retained	Minor scuffing, flattened wire.	Surface	35
2010	Passengers riding out of tow path	0	NA	Not retained	Two platter seats damaged; one hanger arm damaged	Surface	19
2010	Passenger riding out of tow path	0	NA	Not retained	None	Surface	15
2010	Passenger riding out of tow path	0	NA	Retained	None	Surface	15
2011	Passenger unloading error	0	NA	Retained	None	Aerial	24
2011	Wind	0	NA	Retained	None	Aerial	38
2011	Passengers riding out of tow path	0	NA	Not retained	None	Surface	34
2011	Passenger riding out of tow path	1	Possible bruising	Not retained	None	Surface	24
2011	Passengers riding out of tow path	0	NA	Not retained	None	Surface	18
2011	Passenger loading error	0	NA	Retained	None	Surface	17
2011	Passenger swerved and pulled rope out of assembly	0	NA	Not retained	None	Surface	27
2012	Fall on tow path	0	NA	Not retained	None	Surface	18
2012	Wind	0	NA	Retained	None	Aerial	44
2012	Operator contacted carrier	0	NA	Retained	None	Aerial	18

Appendix A3

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
A carrier (T-bar) wrapped around the haul rope and caused the uphill side sheave assembly top station to derope. The haul rope was not retained by rope catchers.	A passenger did not unload correctly and caused the carrier to swing and wrap around the haul rope.
Complete deropement of Tower 10. Two passengers were riding T carrier #3 and had passed the unload area when the deropement occurred. The haul rope struck one of the passengers.	Ski tracks to the inside of the tow path indicate that the passengers may not have been on the tow path as they approached Tower 10. The tow path had bumps from regular use that could have affected the passengers' ability to stay on the tow path. The sheave liner on Sheave #1 at Tower 10 (uphill) was beginning to delaminate and some material on the side of the sheave liner was missing. The groove, however, was still in tact. This may not have caused the deropement but may have affected the liner's sidewall strength and its ability to hold the rope in the correct position.
Deropement of Tower #1 uphill. The haul rope was not retained by the cable catchers and the deropement switch was not activated.	The operator observed the passenger (snowboarder) riding out of the tow path.
Retained deropement.	The passenger left the track to the outside and pulled the rope off the lead-in.
Retained deropement at Tower #4 uphill.	A passenger fell.
Retained deropement at the drive station.	Improper unload by passenger; Improper handle release.
The haul rope partially derroped from its normal running position at Tower 14 (light side, lead out). The deropement occurred during pre-operational tests before operation.	Poor sheave assembly alignment; Sheaves were changed due to wear during summer line maintenance. No adjustments to correct the alignment during line maintenance.
A full deropement occurred at Tower 9. The haul rope was not retained by the catcher and came to the ground (tow path).	A passenger (beginner snowboarder) fell on the tow path prior to Tower 9. The carrier T shaft may have swung up and onto the communication messenger on recoil, or the carrier swing after the passengers fall may have caused a violent swing that resulted in the carrier contacting the assembly and prying the rope off.
Deropement from Sheave #1 uphill side of top station.	Passenger (snowboarder) did not unload correctly; passenger was riding out of the tow path.
Deropement at unload station. A passenger pushed off the chair as he unloaded and caused the chair to swing and derope on the downhill side.	The passenger caused the chair to swing as he tried to keep his balance while falling. The operator watched the passenger continue down the ramp and ensured the passenger was ok. As the operator's attention was averted towards the passenger, he failed to notice the affected carrier continue around the bull wheel. The momentum from the swing caused the haul rope to derail at the unload tower light side.
Complete deropement of tower 4 uphill side. Rope missed rope catchers and was retained on cross arm. (Hold down tower) Rope was also running on the sheave flanges on tower 2.	A passenger (skier) was out of the tow path on a surface lift T-bar, causing the haul rope to derail from the sheave assembly.
A carrier struck the tower carrier deflector, causing a deropement at Tower #14 downhill side.	A passenger did not unload correctly at the uphill side of the unload station. This caused the carrier to swing wildly as it entered the bull wheel. The momentum of the carrier continued as it exited the bull wheel on approach to Tower #14 and contacted the tower carrier deflector.
The carrier T wrapped around the haul rope at the unload point and went around the bull wheel. It became hung up on the lead out guide sheave, snapped the T rope, and then derailed the lead out guide sheave wedging the haul rope between the sheave and inside deropement guard. The haul rope derailed at a return station sheave assembly.	A surface lift T did not properly retract. The passenger unloading from the carrier may have contributed.
The haul rope was pulled from the sheave assembly and missed the rope catcher. The haul rope hit the ground (tow path) and settled approximately three feet above the tow path.	Passengers were weaving off of the tow path while riding a surface platter.
A deropement occurred at Tower #2. The haul rope was pulled off she sheave assembly and was not retained by rope catchers.	A passenger (snowboarder) was riding out of the tow path, over the berm. This is a small platter lift (single passenger) with lightly loaded towers, this type of occurrence happens when passengers ride far out of the track, some times this type of incident is intentionally caused by passengers.
Partial deropement of return station uphill sheave assembly.	A passenger (skier) was not riding under the haul rope.
A deropement of the incoming lead-in guide sheave occurred at the return station.	A passenger (snowboarder) caused the chair to swing excessively as he unloaded from the chair.
The haul rope came out of the sheaves and landed on the rope catcher at Tower #5, heavy side.	High winds caused the haul rope to come out of the sheaves.
Deropement of Tower #2, uphill side. The haul rope was not retained by rope catchers and ended up slightly above the sheave assembly.	Deropement may have been caused by passengers riding out of the track, or unloading from the ropeway prior to Tower #2.
Deropement of Tower #6, uphill side. The rope was not retained by the rope catchers. The haul rope ended up approx 2 meters above the snow once line bounce had stopped. One passenger was hit on the thigh/hip area by the carrier as it came down.	The sheave assembly on Tower #6 uphill is a 4-sheave support assembly (4T). Lift maintenance staff observed tracks six to eight metres outside the normal tow path. It appears that the haul rope was pulled from the sheaves by a passenger riding out of the track. There was minor marking on the lead-in cable catcher - this is may be where the rope contacted the carrier and came out of the sheaves.
A deropement occurred at Tower #2. The haul rope was not retained by the rope catcher.	While riding, a group of passengers (ski racers) veered to the outside of the track and pulled the haul rope off the sheaves at tower #2.
A partial derail occurred on the uphill side return station assembly. The rockers were seized, the assembly did not articulate as intended and the derail fork did not break. The stop was initiated by the attendant.	Improper loading procedure; The sheave assembly was not properly serviced during annual maintenance (i.e. the rockers should have been freely articulating after maintenance)
A deropement occurred on Tower #2, uphill side.	A passenger (inexperienced skier) swerved and pulled the rope out of the combination assembly. The tow path required grooming which may have caused the passenger to swerve. Sheave liner wear and minimal combination sheave assembly interference may have been a contributing factor.
A deropement occurred. Rope was not retained and the tower fault was not actuated. The attendant initiated the lift stop.	Sudden lateral loading to the haul rope after passengers fell after loading. The sheave assembly did not articulate enough to cause the break fork to break.
A deropement occurred at Tower #5, downhill side.	A sudden, strong gust of wind caused the cable to derope.
A carrier contacted tower #12, causing it to derail the haul rope off the sheave assembly.	A carrier was bumped as it came around the bull wheel by an operator on the drive room roof shovelling snow. The carrier left the terminal with a lot of sideway swing and hit Tower #12.

Appendix A3 Deropement Incidents (January 2009 – June 2014) Continued

TABLE A3-5: SUMMARY OF DEROPEMENT INCIDENT INVESTIGATIONS

YEAR	CAUSE CATEGORY	QTY. INJURIES	INJURY DESCRIPTION	DEROPEMENT TYPE	DAMAGE	ROPEWAY TYPE	INSTALLATION AGE
2012	Ice accumulation	0	NA	Not retained	None	Surface	39
2012	Passenger riding out of tow path	0	NA	Retained	None	Surface	19
2012	Fall on tow path	0	NA	Not retained	Carrier #5 damaged and removed from service; incoming inside haul rope deflector damaged and replaced	Surface	25
2012	Passenger unloading error	0	NA	Not retained	Broken platter rope	Surface	39
2012	Excessive swing on start-up	0	NA	Retained	None	Surface	39
2012	Swinging carrier	0	NA	Retained	None	Surface	19
2012	Passenger riding out of tow path	0	NA	Retained	Break fork assembly damaged	Surface	18
2012	Passenger unloading error	0	NA	Not retained	None	Surface	32
2013	Passenger riding out of tow path	0	NA	Retained	None	Surface	1
2013	Installation error after service/ maintenance	0	NA	Not retained	Bent incoming deropement guard	Surface	44
2013	Passenger riding out of tow path	0	NA	Retained	Break fork assembly damaged	Surface	19
2013	Fall on tow path	0	NA	Not retained	Broken Tee rope	Surface	42
2013	Passenger unloading error	0	NA	Retained	None	Surface	1
2013	Passenger unloading error	0	NA	Retained	None	Surface	1
2013	Swinging carrier	0	NA	Retained	None	Surface	1
2013	Swinging carrier	0	NA	Retained	None	Surface	1
2013	Passenger unloading error	0	NA	Not retained	None	Surface	26
2013	Passenger unloading error	0	NA	Not retained	None	Aerial	26
2013	Passenger unloading error	0	NA	Not retained	T-bar grip and hanger assembly damaged; scuffing on 10 metres of haul rope	Surface	1
2013	Passenger riding out of tow path	0	NA	Retained	None	Surface	19
2013	Passenger unloading error	0	NA	Not retained	None	Surface	1
2013	Passenger riding out of tow path	0	NA	Retained	None	Surface	33
2013	Passenger loading error	0	NA	Retained	Minor scuffing to haul rope	Surface	19
2013	Sheave assembly component failed	0	NA	Retained	"Rosta" sheave element damaged	Surface	19
2013	Passenger riding out of tow path	0	NA	Retained	None	Surface	20
2014	Irregular carrier retraction	0	NA	Retained	None	Surface	19

Appendix A3

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
Deropement of tower 8 downhill side sheave assembly, haul rope was not retained by rope catchers.	Incident occurred overnight during a storm cycle. Icing and rhime on haul rope caused reduced load on hold down assembly which, along with high winds, pushed haul rope off sheave assembly.
Deropement of the uphill side sheave assembly of the bottom station. The rope was retained by the rope catcher and the break fork switch caused the lift to stop.	A passenger skied away from the tow path.
Tower #4 deroped on the uphill side, missed the cable catchers and the haul rope ended up approximately 2.5 metres above the snow surface.	A passenger fell on the tow path, allowing the carrier's T seat to fly up and become jammed in the carrier grip. This then acted as a pry bar and forced the haul rope off the sheave assembly.
A deropement occurred on Tower #4, downhill side. The rope was not retained by the rope catcher.	After a passenger unloaded their surface lift platter, the platter carrier swung out and became entangled with the carrier on the down hill side.
Upon starting the surface lift, a carrier swung excessively as it went around the return station bull wheel, contacted the guide sheave assembly, causing the haul rope to derope.	This unit has limitations with the soft start drive, the combination of the radical acceleration and perfect positioning of the carrier on the bull wheel caused the carrier to swing on start up.
A deropement occurred on the uphill side of Tower #1. The rope was retained by the catcher.	The swinging platter rope became entangled in the grip.
A deropement occurred at Tower #4. The haul rope was retained by the inside rope guide.	A passenger veered to the inside of the tow path, forcing the haul rope out of the sheave liner grooves and onto the inside rope guides.
A deropement occurred on a surface T-bar ropeway. The haul rope was not retained.	Passengers (two snowboarders) did not unload at the correct location. They tried to pull hard to the left to clear the unload area. This caused the springbox to swing wildly as it entered the bull wheel. As the carrier exited the bull wheel it deroped from the sheave assembly (4-sheave assembly). This T-bar is 'left hand up' (clockwise drive direction) and is a bull wheel unload. This type of T-bar can be prone to deropement when passengers do not unload correctly. There is a large instructional sign on the return station showing how to unload correctly; these passengers did not follow the requirements.
The cable came off at Tower #10 and was caught by the cable catcher.	A passenger (skier) may have veered too far to the left (outside), pulling the cable off the sheave wheel groove.
A carrier struck the tower sheave equipment, causing a deropement.	A carrier was installed on the haul rope incorrectly after servicing, i.e., the springbox was installed backwards.
A deropement occurred at Tower #4 uphill side. The rope was retained by the inside guide.	A passenger veered to the inside of the tow path, causing the haul rope to be pulled out of the sheave liner groove and against the inside sheave assembly guide. A fence was not installed to prevent passengers from veering out of the tow path.
A T-seat hooked onto Tower #7, causing an unretained deropement on a surface lift.	A passenger fell on the tow path.
A deropement occurred at Tower #10, uphill side. The haul rope was pushed out of position but was retained by the cable catcher.	After reaching the top of the hill, a passenger (skier) released the T-bar. The T-bar hit the plastic barrier in place before the safety gate. The T-bar bounced off the barrier and was flung in between the lift cable and the wheels of Tower #10.
A retained deropement occurred at Tower #10, unload area.	A passenger unloaded irregularly, causing a swinging motion. The swinging T-bar (stem and seat) collided with the centre of Tower #10.
A deropement occurred at the uphill side of Tower #10.	Tower #10 is located after the unload area. A swinging carrier may have resulted in the haul rope lifted and pulled out of the sheave liner groove and then riding over the sheave side plates and onto the rope catcher.
A deropement occurred on the uphill side of Tower #1. The rope was retained by the catcher.	A swinging carrier may have pulled the rope off Tower #10. The per-sheave loading of the uphill side of Tower #10 was below required values.
A deropement occurred at Tower #8 (hold down), uphill side. The rope was not retained and settled approximately 30cm above the sheave assembly.	High winds were reported at the time of the incident. Because the carrier was just beyond the deroped tower, it is speculated that the deropement may have been passenger related (i.e., passenger may have caused the deropement).
Deropement of a return station guide sheave on a 2-wheel assembly.	The carrier was pushed out while a passenger (snowboarder) was unloading, levering the rope from the groove of the sheave. There was no rope catcher on the assembly.
The carrier swung after the passengers unloaded and caused the deropement of two towers.	Two passengers (skiers) unloaded t-bar to the left of the tow path. The spring box and hanger assembly swung to the inside of the lift line as it entered the sheave assembly.
Partial deropement at the unloading station. The rope was retained by the rope catcher.	The passenger skied the platter assembly to the outside of the tow path, pulling the haul rope off the guide sheave assembly. The unload operator had not been watching the area prior to the unload to watch for this behaviour.
The T-bar swung erratically and contacted the Tower 10 assembly.	The T-bar was released outside of the tow path. Tower 10 was lightly loaded.
A passenger observed a partial deropement of the first sheave on Tower 7 uphill as he was riding up the T-bar. As the passenger's carrier went through Tower #7, the haul rope completely deroped and was retained by the rope catchers.	Possibly caused by the passenger not riding in track (tow path).
When a passenger entered the loading area of the lift, the operator grabbed a platter on the downhill side prior to the guide sheave assembly. The passenger failed to ready himself and the operator reacted by swinging the platter (in an attempt to avoid contacting the passenger). The haul rope was retained, however, slipped off to the inside of the rope catcher and made contact with the assembly. A platter grip also made contact with the assembly and the grip slid on the haul rope approximately 150mm.	The passenger was not ready to load. The lift attendant swung the carrier away from the passenger to avoid contact, causing the deropement. The swing caused the deropement of the incoming load station guide sheave assembly. The loading procedure of grabbing the platter on the incoming side of the bull wheel was also a contributing factor.
Deropement on Tower 4 down-hill side.	The "rosta" element failed on a two-support one-hold down ("rosta") sheave assembly. The failure caused the compression sheave force to be relieved, allowing the haul rope to leave the centre of the assembly.
A passenger skied out of the tow path on the platter lift and caused a deropement. The haul rope was retained by the rope catchers.	A passenger (snowboarder) disregarded signage and delineators and skied out of the tow path at the mid-unload area at tower #2.
A deropement occurred at the unload guide sheave assembly.	A passenger (snowboarder) turned his snowboard sideways in a 'snowplow' maneuver on approach to the platter lift unload station. This maneuver added extra tension on the platter. The passenger released the platter and it entered the unload bull wheel swinging and not fully retracted. The residual energy caused the platter to derope at the unload side guide sheave assembly.

Appendix A3 Deropement Incidents (January 2009 – June 2014) Continued

TABLE A3-5: SUMMARY OF DEROPEMENT INCIDENT INVESTIGATIONS

YEAR	CAUSE CATEGORY	QTY. INJURIES	INJURY DESCRIPTION	DEROPEMENT TYPE	DAMAGE	ROPEWAY TYPE	INSTALLATION AGE
2014	Ice accumulation and freezing rain	0	NA	Retained	Eleven carriers damaged; one grip damaged; lead-in four-sheave assembly pin hole in main assembly elongated from Tower 11 (may not be related to incident, possibly previous wear)	Aerial	45
2014	Passengers riding out of tow path	0	NA	Not retained	Bent lead-in 2-sheave assembly; two lead-in rope guards bent; scuffing on haul rope; possible damage to carrier grip	Surface	2
2014	Lack of operational experience in installation location	0	NA	Not retained	Damage was limited to passenger carrier 17, the sheave assembly at tower 7 and the haul rope.	Aerial	0
2014	Fall on tow path	0	NA	Not retained	None	Surface	2
2014	Passenger riding out of tow path	2	1 - Fractured shoulder, 1 - bruises	Not retained	None	Surface	2
2014	Passenger unloading error	0	NA	Retained	None	Surface	27
2014	Passenger unloading error	0	NA	Retained	None	Aerial	27
2014	Swinging chair contacted a tower	4	4 – Injuries requiring hospital treatment	Not retained	Five carriers, haul rope, tower sheave assembly components damaged	Aerial	47
2014	Ice accumulation	0	NA	Retained	None	Aerial	19
2014	Wind	0	NA	Retained	None	Surface	27
2014	Passenger unloading error	0	NA	Retained	Distorted wires in 6 locations, a dent in the upper rim of the bull wheel, damage to the T-bar seat, inside rope guard on the uphill side return station guide sheave assembly destroyed.	Surface	41

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
Towers 11 and 12 on the uphill side deroped. The haul rope was retained by the rope catchers. This deropement occurred prior to operation.	Freezing rain caused ice accumulations on the underside of the sheave assemblies on Towers 11 and 12. The ice accumulation caused the haul rope to bounce and slide off the assembly when the chairlift was ran. The morning staff also did not get a good visual on the condition of the towers prior to starting the lift.
The haul rope was pulled off Tower #1 uphill side sheave assembly.	Two passengers skied outside of the tow path and around a delineation fence intended to keep the passengers in the tow path. Skiing outside the tow path caused a force on the haul rope to pull the rope from the sheave assembly at Tower #1. The resultant bounce of the haul rope caused the load area guide sheave assembly on the uphill side to also derope.
An unoccupied gondola carrier travelling downhill became detached from the rope and fell to the ground.	The carrier swing exceeded the swing clearance required by the design standard and caused the carrier detachable rope grip torsion tube to contact a rope catching device on the tower equipment and forcibly removed the grip from the haul rope. The investigation into the failure of the gondola cabin's detachable rope grip to maintain its holding force on the haul rope found that the incident occurred due to operational error. The owner (a passenger ropeways contractor) lacked experience operating passenger ropeways at this particular location and there were no existing passenger ropeways in the same area to give the operators a sense of how passenger carriers may have been reacting. The following causal factors have also been identified: - Strong wind speed on the day of the incident. - The gondola cabin involved in the incident was empty and therefore its geometry was more susceptible to the influence of wind, and - Limited experience of the passenger ropeway operators.
Two passengers fell after loading the T-bar. The passengers became entangled in the carrier. After releasing themselves from the carrier, the carrier became entangled with a plastic delineation fence pole and the resulting tension pulled the haul rope off the up hill side Tower #1 sheave assembly.	After the passengers fell, the lift operator did not stop the lift. The operator was not monitoring the lift line when the T became entangled with delineation fencing. A delineation fence had been erected using snow fencing and plastic poles to the users left hand side of the tow path. When the passengers became untangled and threw the T, the T hooked onto the fencing's third pole up from the load area. The pole bent over but did not pull out of the snow and this caused the full length of the T-bar rope to extended and pull tension. The tension created by the T being entangled with the fence pole caused the haul rope to be pulled off of the up-hill side tower #1 assembly. Upon further investigation it was discovered that due to rope twist and misalignment of the assembly T, grips were making contact with sheave flanges and hanger arm assemblies were making contact with rope catchers. this will cause a prying action that would have contributed to deropements.
Deropement of Tower #1 uphill side sheave assembly. The haul rope fell and contacted two passengers, resulting in injuries.	A passenger riding the ropeway may have initiated the deropement by causing a side load to the haul rope (by skiing or riding the lift outside of the towpath). However, it is worth noting work was conducted prior to the incident to address rope-sheave alignment issues at the drive station and tower #1. Based on the operator's report, it can be assumed that poor rope-sheave alignment and worn sheave liners were a contributing factor to the deropement. The report also indicated that the tensioning system was not functioning as per design, which may also have contributed to the deropement.
Deropement of downhill side of top station bull wheel guide sheaves.	A passenger (skier) did not unload correctly and pulled the T to the left, causing the T to slingshot and the carrier to swing exiting the bull wheel. This caused the haul rope to leave the sheaves.
The haul rope deroped from the incoming two-wheel station sheave assembly.	A passenger (snowboarder) pushed away from the carrier (aggressive lateral push) as he was unloading, causing the haul rope to move out of the sheave wheel grove and over the side plate.
A full deropement of a fixed-grip double chairlift occurred. Three carriers (chairs) fell, two of the chairs carrying passengers.	A swinging chair struck a tower, causing a full deropement. A non-functioning tensioning system was also discovered.
The haul rope ran out of its normal running position on the tower sheave during morning start up. The ropeway ran 10 to 15 metres at 10% speed.	Ice accumulation on an above-surface ropeway.
A deropement occurred during morning start up and there were no passengers on the ropeway at the time of the incident.	High winds caused the haul rope to derope.
The return station uphill side portal assembly deroped. A T-bar seat became entangled with a guide sheave assembly. The T-bar seat rope broke and the assembly derailed. The carrier assembly entered the bull wheel at an unusual angle as the lift was stopping and caused the haul rope to leave the bull wheel liner. The haul rope was retained by the carrier guide ring on the bottom of the bull wheel.	A passenger may have unloaded improperly, pulled the T outside of the tow path, and released the T very late in an attempt to reach the entrance of a nearby run. This improper unload situation caused the T to retract late and with some force, causing the T rope to swing over the inside of the haul rope and become lodged under the grip.

Appendix A4 Carbon Monoxide Incidents (2007-2013)

This listing provides an overview of the incidents involving carbon monoxide (CO) that were reported and investigated by BCSA safety officers. It is important to note that BC Safety Authority does not regulate all fuels that produce CO, therefore occurrences involving fuels not regulated by BCSA are not considered in this listing.

Incidents involving work or equipment regulated under the *Safety Standards Act* are required to be reported to the appropriate provincial safety manager. The Province of British Columbia, however, delegated partial administration of the *Safety Standards Act* to a number of local governments. These local governments administer gas assessment programs for detached dwellings with gas services at a pressure of 14.0kPa gauge or less with a total connected load for the meter of 120kW or less and are identified in Appendix H. Gas incidents, including carbon monoxide incidents, occurring in these municipalities would be reported to the local government safety manager and may not be reported to BC Safety Authority.

BC Safety Authority receives its injury reports and descriptions from operators or first responders at the time of, or immediately following, the incident. Injuries may develop after the initial reports were made to BC Safety Authority and the long term effects of a resultant injury may not be recorded as part of the BCSA investigation.

TABLE A4-1: CARBON MONOXIDE INCIDENT INVESTIGATIONS

		INJURY TYPE						EQUIPMENT			
INCIDENT DATE	CITY	TOTAL INJURED/ AFFECTED	FATAL INJURY	HOSPITALIZED/ HOSPITAL VISIT RECOMMENDED	NO INJURY REPORTED BUT AFFECTED/ DISPLACED	CAUSE CATEGORY	OCCUPANCY PREMISE/TYPE	IDENTIFIED IN INVESTIGATION	SOURCE OF CO	POSSIBLE SOURCE OF CO	GAS TYPE
17-Mar-07	Surrey	1	0	0	1	Equipment failure	Residential	Furnace, water heater	Furnace	Water heater	Natural gas
11-Apr-07	New Westminster	None	0	0	0	Component failure	Residential	Makeup air unit	Makeup air unit		Natural gas
20-Apr-07	Prince George	2	0	1	1	Lack of maintenance	Residential	Furnace	Furnace	-	Natural gas
2-Jul-07	Vernon	2	2	0	0	Incorrect installation	Recreational (Cabin)	Refrigerator	Refrigerator	-	Propane
6-Jul-07	New Westminster	None	0	0	0	Vent obstructed; Combustion products unable to vent	Residential	Pool boiler	Pool boiler	-	Natural gas
18-Jul-07	Duncan	1	0	1	0	Component failure	Residential	Furnace	Furnace	-	Natural gas
5-Oct-07	Coquitlam	2	0	2	0	Equipment service/replacement	Residential	Furnace	Furnace	-	Natural gas
27-Nov-07	Sun Peaks	6	0	6	0	Combustion products unable to vent	Residential	Boiler	Boiler	-	Natural gas
14-Dec-07	Pitt Meadows	4	0	4	0	Unable to determine cause	Residential	Furnace	-	Furnace	Natural gas
26-Jan-08	Denman Island	1	1	0	0	Unable to determine cause	Camperized vehicle	Catalytic heater	-	Catalytic heater	Propane
11-Apr-08	Vancouver	None	0	0	0	Combustion products unable to vent	Commercial	Fireplaces, boilers, make-up air units, ranges	Fireplaces, boilers, make-up air units, ranges	-	Natural gas
18-Jun-08	Armstrong	27	0	27	0	Combustion products unable to vent	Industrial	Boiler	Boiler	-	Natural gas
1-Sep-08	Lumby	5	0	5	0	Lack of maintenance	Recreational (Cabin)	Refrigerator, cook top/ stove	Refrigerator	cook top/ stove	Propane
24-Oct-08	Charlie Lake	2	0	1	1	Equipment failure	Residential	Furnace	Furnace	-	Natural gas
29-Nov-08	Langley	2	0	2	0	Lack of maintenance	Residential	Furnace	Furnace	-	Natural gas
6-Dec-08	Burnaby	None	0	0	0	Combustion products unable to vent	Residential	Roof top air handing unit	Roof top air handing unit	-	Natural gas
3-Jan-09	Surrey	None	0	0	0	Regulated work by unqualified person	Residential	Furnace	Furnace	-	Natural gas
30-Jan-09	Dawson Creek	4	0	0	4	Combustion products unable to vent	Commercial	Furnace	Furnace	-	Natural gas
2-Feb-09	Merritt	5	0	0	5	Lack of maintenance	Commercial	Pool boiler	Pool boiler	-	Natural gas
26-Oct-09	Surrey	3	0	0	3	Combustion products unable to vent	Residential	Hot water heater, hot water boiler	-	Hot water heater, hot water boiler	Natural gas

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INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
A person was exposed to CO. The person was taken to hospital but decided not to stay because there was a six hour wait; by the time the person arrived at the hospital, the person claimed he was feeling better.	Defective gas appliances and associated venting.
An odour was reported at a condominium building; building was evacuated.	The fan belt was found to be broken, which would have caused improper venting. Combustion products could have been drawn into the makeup air in-stream and pumped into hallways. A copper sensing tube was found lying in the bottom of the switch compartment.
Gas utility responded to an odour call.	Cracked heat exchanger and flame roll-out due to lack of maintenance.
Two people died from CO exposure.	The cabin was built of tight construction with little air leakage; no combustion air brought into the cabin; refrigerator was not installed to manufacturer's recommendations.
A person contacted his gas contractor after noticing dew-like condensation on the basement walls.	About six months prior, the contractor had replaced the home's hot water heater and furnace and common-vented into a masonry chimney. The contractor was not aware of the pool boiler that was located in a different area of the basement. The chimney liner that was installed to accommodate the replaced appliances (water heater and furnace) which blocked the chimney vent for the pool boiler. The boiler then spilled at the draft hood due to a blocked vent.
A person was taken to hospital and treated for CO poisoning.	The heat exchanger was cracked and allowed CO to enter the circulating air stream.
Two people were taken to hospital with possible CO poisoning.	The roof's rain cap on the B-vent was changed when the house was re-roofed earlier in the year. The rain cap was replaced with the incorrect type and partially blocked the B-vent. The furnace filter was the wrong size and the door of the blower compartment was partially open.
Six people were taken to hospital with CO poisoning.	The boiler's vent termination pipe was dislodged and the boiler would continue to shut down where the pipe became dislodged. The boiler would then shutdown and 'recycle itself' continuously. During start-up, the boiler was producing more than 1000ppm and decrease to 47ppm at high-fire.
A person and her three children were treated for CO poisoning.	The utility technician tested for CO; detected CO at the furnace.
A deceased person was discovered in a burned out camperized van.	It is unknown if fire was started by vehicle's electrical system, smoking materials, or operation of catalytic heater within vehicle. If heater was in use, CO poisoning/ impairment was possible, or heater could have ignited combustibles inside vehicle. It is possible the deceased was using the heater within the van and was overcome by CO and that the heater could have produced CO by operating the appliance in an enclosed space without adequate air supply. It is also possible that the heater was placed too close to combustible material and caused ignition.
A gas odour was reported to the fire department.	A tarp was temporarily installed for roof repairs. All of the B-vented appliances (gas fireplaces, boilers, make-up air units, ranges) were venting to the space below the tarp. Combustion products were trapped under the tarp where it was recirculated by roof top equipment and heating appliances. The CO then migrated throughout the building by the hall pressurization equipment.
Twenty-seven people were taken to hospital for CO poisoning.	A "negative from the fan coil unit" caused the boiler not to vent. The amount of rust on the back of the boiler indicated the boiler had not been vented for an extended period of time.
Five people were taken to hospital for treatment after exposure to CO.	Inspection of the premise revealed one ventless propane refrigerator and one cook-top stove. There was no combustion air into the premise; the refrigerator had not been serviced for some time. The refrigerator vent was partially plugged, the burner was not burning properly as the air shutter for the burner was not adjusted properly. There were carbon deposits on the burner and air shutter.
Two people were affected by CO.	Faulty mobile home gas furnace.
Two people were treated for CO poisoning.	A gas contractor inspected the furnace and found a crack in the heat exchanger. The heat exchanger failed due to the age of the equipment and lack of service.
The utility responded to a CO alarm call.	CO source was determined to be the roof top air handing unit. Three power-vented boilers were 20ft away on the same wall as the air handling unit; combustion products were drawn into the air intake.
A person awoke to found his residence filling with smoke. Although it was determined that the smoke originated from combustible debris left in the furnace, further investigation identified several performance issues with the furnace.	The installer failed to remove the paper or cardboard at the furnace warm air plenum. The installer was not a qualified fitter and the contractor was not licensed.
A gas leak was reported to the fire department. Inspection revealed furnace was producing CO.	The return air had been removed and terminated within the furnace room. The return air caused the furnace to back-vent and allowed combustion products to enter the building.
Five people experienced effects of CO.	Heat exchangers on the pool boilers were plugged due to lack of maintenance. Venting was restricted and spilled from the appliances. The door was propped in an open position, allowing vent gases/ combustion products to be drawn from the mechanical room into the common pool area.
Complaints of CO symptoms affecting three people.	A lower and upper suite was found with gas heating appliance exhaust vents not connected to the main vent. When in operation, the apoliance's exhaust gases would enter the dwelling. Occupants were unaware of the unsafe condition until advised by the utility technician. Condition could have existed for five months.

Appendix A4 Carbon Monoxide Incidents (2007-2013) Continued

TABLE A4-1: CARBON MONOXIDE INCIDENT INVESTIGATIONS

		INJURY TYPE						EQUIPMENT			
INCIDENT DATE	CITY	TOTAL INJURED/ AFFECTED	FATAL INJURY	HOSPITALIZED/ HOSPITAL VISIT RECOMMENDED	NO INJURY REPORTED BUT AFFECTED/ DISPLACED	CAUSE CATEGORY	OCCUPANCY PREMISE/TYPE	IDENTIFIED IN INVESTIGATION	SOURCE OF CO	POSSIBLE SOURCE OF CO	GAS TYPE
27-Nov-09	Burns Lake	2	1	1	0	Incorrect installation	Residential	Fireplace, boiler	Fireplace, boiler	-	Natural gas
14-Dec-09	Delta	None	0	0	0	Unable to determine cause	Residential	Furnace	Furnace	-	Natural gas
29-Dec-09	Kamloops	None	0	0	0	Combustion products unable to vent	Residential	Pool boiler	Pool boiler	-	Natural gas
4-Jan-10	Prince George	1	0	0	1	Lack of maintenance	Residential	Hot water heater, Furnace	Hot water heater	Furnace	Natural gas
15-Mar-10	Vernon	1	0	0	1	Combustion products unable to vent	Residential	Furnace	Furnace	-	Natural gas
18-Apr-10	Prince Rupert	2	0	0	2	Combustion products unable to vent	Residential	Boiler	Boiler		Natural gas
20-Apr-10	Chemainus	1	0	0	1	Combustion products unable to vent	Residential	dual fuel range	dual fuel range	-	Natural gas
19-Aug-10	Victoria	None	0	0	0	Incorrect installation	Residential	Water heater	Water heater	-	Natural gas
14-Oct-10	Agassiz	1	0	0	1	Lack of maintenance	Residential	Furnace	Furnace	-	Natural gas
20-Oct-10	West Vancouver	None	0	0	0	Intentional bypass of safety measures	Residential	water heater, camp stove burner	water heater, camp stove burner	-	Natural gas
12-Dec-10	Kelowna	2	1	1	0	Incorrect installation	Residential	Furnace, fireplace	Furnace, fireplace	-	Natural gas
25-Jan-11	Squamish	None	0	0	0	Lack of maintenance	Commercial	Roof top heating unit	Roof top heating unit	-	Natural gas
30-Jan-11	Cumberland	None	0	0	0	Poor air-gas ratio	Commercial	Boiler	Boiler	-	Natural gas
4-Feb-11	Dawson Creek	None	0	0	0	Combustion products unable to vent	Residential	Furnace, hot water tank	Furnace, hot water tank	-	Natural gas
28-Mar-11	Vancouver	1	0	1	0	Combustion products unable to vent	Commercial	Unit heaters	Unit heaters	-	Natural gas
23-Aug-11	Surrey	None	0	0	0	Component failure	Residential	Water heater	Water heater	-	Natural gas
17-Oct-11	Prince George	4	0	4	0	Equipment failure	Residential	Water heater, furnace	Water heater	Furnace	Natural gas
5-Dec-11	Armstrong	1	0	0	1	Unable to determine cause	Residential	Fireplace	Fireplace	-	Natural gas
22-Dec-11	Penticton	2	0	0	2	Lack of maintenance	Residential	Furnace	Furnace	-	Natural gas
24-Dec-11	Whalley	None	0	0	0	Combustion products unable to vent	Residential	Water heaters	Water heaters	-	Natural gas
7-Jan-12	Langley	None	0	0	0	Equipment failure	Residential	Furnace	Furnace	-	Natural gas
7-Feb-12	Langley	5	0	5	0	Vent obstructed; Combustion products unable to vent	Residential	Boiler, water heater	-	Boiler, water heater	Natural gas

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INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
One person died from CO poisoning; another person was hospitalized.	An exhaust power venter was improperly installed on an existing natural gas boiler. The venter was installed by a registered gas contractor approximately two months prior to the incident; the manufacturer's instructions were not followed. Investigation revealed that the venter ran 50% of the time while the boiler was fired; otherwise, the boiler spilled combustion products into the residence.
A utility technician shut down a gas furnace after a high concentration of CO was detected.	(Not described)
People phoned emergency services when their CO detector sounded.	The installation is over 20 years old and does not meet current code requirements. The change room had the combustion air supply blocked off to prevent cold air from freezing the water lines in the room and an interior door to the building was left open. The negative pressure in the building (house) and lack of an air supply to the room caused the back-drafting.
A person experienced CO poisoning after CO detector alarms sounded.	Testing found that the hot water heater was spilling combustion products resulting in an elevated CO level. The hot water heater displayed evidence of corrosion and inadequate maintenance. A passive 4" combustion air source was located in the equipment room in addition to the combustion air grille located in the supply plenum of the furnace. The furnace return air ducting was reasonably tight, the filter access had no cover. No indication of back-drafting at the appliance draft hoods.
A person experienced symptoms of CO exposure.	The furnace was enclosed in a small space; no combustion air. There was a 6" hole in the return air duct close to the burner. The lack of combustion air and large opening in the return air plenum caused a negative pressure in the furnace space, causing flame rollout and incomplete combustion, and distribution of the combustion products throughout the premise.
Two people were taken to hospital for carbon monoxide poisoning.	The vent was dislodged from the boiler.
A hospital test revealed that a person had an elevated CC.	The utility technician measured CO coming from the dual flame burner on a dual fuel range with a gas cook top. The dual flame burner had a glass centre. When the burner is "on," the flame seemed to impinge on the glass, producing CO with or without a pot or pan on it. The other three burners produced 40ppm CO on start up and reduced to negligible when warm. Owner was not using the microwave exhaust fan when using the range.
The fire department responded to an odour call and CO detector alarm call.	The gas water heater serviced three suites. The atmospheric water heater was vented into a dilapidated chimney that served the entire building. The 3" chimney vent connector was taped into the main chimney; no liner in the chimney. There was no combustion air into the common suite where the water heater was located.
Emergency services were called when a person was found unresponsive.	The appliances appeared that they have not been serviced. The masonry chimney was completely plugged where the furnace connects to the vent connector. The vent connector from the furnace was partially plugged by debris from the masonry chimney. The furnace had large rust particles from the heat exchanger laying across the burner. Its is possible that the furnace heat exchanger had holes in it.
A water heater was damaged by a home made burner assembly.	A person assembled a makeshift burner to keep the water hot after the utility had plugged the fuel supply. The home-made hose and burner assembly was not secured to the water heater. The orifice was not secured to the burner and was likely to have caused severe damage and/or injuries. Pets could have dislodged the orifice, which could have caused the basement to fill with propane gas.
One person died from suspected CO poisoning. A second person was hospitalized for treatment.	The furnace fan and/or dryer put the home into a negative pressure condition which caused the fireplace B-vent to down draft. The furnace duct system in the insulation space under the premise was not tightly sealed and caused a substantial negative pressure in the home when the furnace air circulation fan was operating. The fire place appeared to be in good condition during a visual check. The fireplace was disassembled and it was noted that there was soot on the ceramic log set. The centre log had damaged retaining tabs which allowed the log to fall against the front log, restricting the flame path and causing the flame to be impinged. This caused the soot and CO.
A rooftop heating unit developed corroded and plugged burners. Excessive debris accumulated in the combustion chamber.	Lack of maintenance over time caused unit deterioration to point where critical components were corroded, holes were created.
Fire-side boiler explosion.	Flue gas analysis on boiler #2 indicated the boiler was in a poor state of air-gas ratio. The boiler was producing more than 2000ppm CO at high fire. The explosion was consistent with an off-cycle combustible explosion.
Combustion products entered into a home after the flue separated.	The flue collar from the flue liner separated from the base tee of the flue assembly.
The utility responded to a gas odour call. A person was sent to hospital.	Venting on unit heaters had holes due to rusting. Investigation revealed that the common venting for the unit heaters did not meet code requirements.
On advise from the utility, a person reported an incident involving the unsafe operation of a gas water heator.	Valve failed
Four people experienced CO symptoms	The water heater was installed in 2006 but recently was experiencing pilot outages. The furnace's combustion blower was not tight, the exhaust vent coupler was not tightened. There appeared to be a lack of service on the water heater and lack of combustion air
A person experienced CO symptoms	The utility found high levels of CO at the top heat grill to the fireplace.
Two people contacted the utility when their CO detector sounded.	Lack of maintenance of the furnace caused the appliance to produce high levels of CO in the flue gas. The combination of the plugged fresh air intake and the use of the wood burning appliances in the home caused a negative condition. This negative did not allow the furnace to vent properly spilling more than 300ppm of CO into the basement. The CO was circulated throughout the home causing the CO poisoning symptoms.
The utility responded to an odour call.	Short B vent height results in poor stack action which occasionally results in the products of combustion from the water heaters spilling into the mechanical room.
The utility responded to an odour call at a residence.	The utility technician confirmed that the furnace was not venting correcting and spilling CO into the residence. Insufficient gas supply caused buildup of carbon within burner. The appliance was being supplied by gas found to be by-passing a gas meter shut-off valve.
People felt ill in their home and contacted emergency services.	Type-B vent termination cap corroded and collapsed onto the vent pipe, causing flue blockage and spillage of combustion products to spill into the residence

Appendix A4 Carbon Monoxide Incidents (2007-2013) Continued

TABLE A4-1: CARBON MONOXIDE INCIDENT INVESTIGATIONS

		INJURY TYPE						EQUIPMENT			
INCIDENT DATE	CITY	TOTAL INJURED/ AFFECTED	FATAL INJURY	HOSPITALIZED/ HOSPITAL VISIT RECOMMENDED	NO INJURY REPORTED BUT AFFECTED/ DISPLACED	CAUSE CATEGORY	OCCUPANCY PREMISE/TYPE	IDENTIFIED IN INVESTIGATION	SOURCE OF CO	POSSIBLE SOURCE OF CO	GAS TYPE
22-Feb-12	Kelowna	None	0	0	0	Regulated work by unqualified person	Residential	Water heater	-	water heater	Natural gas
17-Mar-12	Mission	None	0	0	0	Vent obstructed; Combustion products unable to vent	Residential	Furnace	-	Furnace	Natural gas
1-May-12	Osoyoos	1	0	1	0	Incorrect installation	Residential	Furnace		Furnace	Natural gas
25-Jul-12	Salmo	3	0	1	0	Unable to determine cause	Residential	Furnace	Furnace	-	Natural gas
29-Aug-12	Nelson	None	0	0	0	Wind created down-draft	Residential	water heater	water heater		Natural gas
20-Oct-12	Smithers	None	0	0	0	Venting "was not finished per regulation"	Residential	Boiler	Boiler	-	Natural gas
24-Oct-12	Vancouver	None	0	0	0	Equipment not operating	Commercial	Stock pot	Stock pot	-	Natural gas
31-Oct-12	Abbotsford	None	0	0	5	Regulated work by unqualified person	Residential	Furnace	Furnace	-	Natural gas
29-Nov-12	West Vancouver	None	0	0	0	Venting pipe connection dislodged	Residential	Water heater, furnace	Water heater, furnace	-	Natural gas
16-Jan-13	Salmon Arm	None	0	0	0	Combustion products unable to vent	Residential	Furnace, Hot water heater	Furnace, hot water heater	-	Natural gas
18-Jan-13	Salmon Arm	5	0	5	0	Incorrect installation	Residential	Furnace	Furnace	-	Natural gas
2-Feb-13	Vernon	1	0	0	1	Combustion products unable to vent	Residential	Furnace	Furnace	-	Natural gas
1-May-13	Princeton	1	1	0	0	Regulated work by unqualified person	Residential - non primary (cabin)	Refrigerator, lanterns	Refrigerator	Lanterns	Propane
26-May-13	Burnaby	2	2	0	0	Unsafe use of equipment	Converted industrial	Generator	Generator	-	Propane
6-Jun-13	West Vancouver	4	0	0	4	Incorrect installation	Residential	Boiler	Boiler	-	Natural gas
21-Jul-13	Canoe	4	0	4	0	Incorrect installation	Residential	Furnace, water heater	Water heater	Furnace	Natural gas
4-Oct-13	Cache Creek	1	1	0	0	Unsafe use of equipment	Converted industrial	Furnace, range	Furnace	Range	Propane
11-Nov-13	Surrey	1	0	1	0	Lack of maintenance	Residential	Furnace	Furnace	-	Natural gas
13-Dec-13	Surrey	None	0	0	0	Component failure	Residential	Furnace	Furnace	-	Natural gas
15-Dec-13	Surrey	3	0	3	0	Lack of maintenance	Residential	Boiler, water heater	Boiler, water heater	-	Natural gas

Appendix A4

INCIDENT DESCRIPTION	POSSIBLE CAUSES AND CONTRIBUTING FACTORS
The fire department responded to a CO alarm at a residence.	It appears that an unqualified technician was working on the water heater two days prior to the incident taking place. The individual was called by the owner to repair a water leak and left the water heater running knowing that a part of the venting system was faulty / leaking. The individual intended to let the water heater running until the part came in which created an unsafe situation.
The utility responded to an odour call.	Plugged vent connector; The furnace draft hood outlet was found plugged with fibreglass insulation. The person advised the GSO that a new microwave and exhaust fan was installed. The B-vent (located above the furnace) appeared that it had been relocated from its original location. A 'ball' of fibreglass insulation was found in the vent connector. It is possible that the previous owner plugged the connector to prevent renovation debris from entering the furnace when it was moved, and had forgotten to remove the debris.
A person was sent to hospital for CO exposure.	Appliance installed with non-compliant venting and air requirements.
Three people were treated at hospital for CO exposure.	It was not determined why the furnace was producing CO. The vent and chimney were clear; combustion products were spilling from the draft diverter. The furnace condition was poor; the heat exchanger appeared to be corroded. Cracks in the heat exchanger were present.
The utility responded to a CO alarm at a residence.	"Water heater over fired"; "The home is at the base of a mountain there were high winds and a cool down draft coming off the mountain, coupled with tall cedar trees surrounding this home providing a high probability of a down draft at the gas vent. I suspect that the down drafting caused the products of combustions to spill into the home."
The utility responded to an odour call.	Appliance venting was not finished per regulation. The B vent was not insulated and framed per regulation. Also, the boiler could not vent properly because the hot water tank was replaced with an electric tank which "compounded the stack action."
The utility responded to an odour call.	The exhaust fan was not working properly.
People were exposed to CO.	Unqualified, not knowledgeable person performing regulated work.
An exhaust vent had dislodged, allowing combustion products to be vented into the residence.	Pipe connection dislodged due to the sealant failing to adhere the plastic. The venting was well supported, and there is evidence that both the recommended primer and adhesive was used. It is possible that the elbow was impacted by a person or thing in the area leading to the disconnection. It is also possible the adhesives were subject to some kind of contamination or compromise at the time of application that allowed them to fail (such as moisture, grease, or oil), although none of this was evident at the time of inspection.
The utility responded to a CO alarm at a single-family residence.	Down-drafting appliance vent and obstructed flue. The investigation revealed that when the dryer or kitchen fan was turned on, the furnace and hot water heater would spill flue products.
The utility responded to a CO alarm at a multi-family residence. The utility technician found 200ppm ambient CO in the residence.	A 20-year old high efficiency furnace had a damaged heat exchanger causing high levels of CO in the furnace flue. A one-inch hole had been accidentally drilled through the cell core ABS plastic furnace vent (about 15 years ago). The heat exchanger corrosion and CO in the vent of this type and age of appliance may be common, but with an intact vent pipe, the CO would not usually enter the residence.
Elevated levels of CO were reported at a residence.	Kitchen exhaust fans in tight construction homes caused downdraft of B-vent, allowing flue products from the furnace to spill through the water heater draft hood. Combustion airflexible duct through the roof did not allow sufficient replacement air to make up for the exhaust fan draw.
A person died from carbon monoxide poisoning.	The propane system and appliances were installed by an unqualified individual. The propane RV refrigerator was installed indoors not vented to outdoors, creating hazardous levels of carbon monoxide.
Two people died from CO exposure in an industrial trailer used as living quarters.	Use of a propane generator in an enclosed space.
The utility responded to a gas leak call and detected elevated levels of CO at a residence. The utility technician discovered a leak at a flair fitting on the gas manifold.	The B-vent piping was positively pressurized by a vent fan. The installation was not completed to the manufacturer's specifications, causing leakage.
The utility responded to a CO alarm at a residence.	The gas system in the home was incorrectly installed. The water heater was creating excessive amounts of CO. The home owner temporarily installed a portable air conditioner unit which placed the home into a negative pressure condition which caused the water heater vent to spill CO into the home. The original installation included a ventilation panel through the furnace room door, allowing the negative pressure in the home to affect the venting of the water heater.
A person was found deceased in a cargo trailer which was converted into a living space.	Testing of the furnace suggest CO poisoning if the unit was occupied and furnace was used.
The utility responded to a CO alarm at a residence.	A malfunctioning furnace created excess CO. The furnace had not received regular maintenance by a qualified individual.
The fire department and utility responded to a CO alarm at a residence.	The furnace was found to have a defective heat exchanger allowing carbon monoxide to enter the home.
The utility responded to a CO call.	Plugged heat exchanger on hot water boiler caused combustion products to spill into the residence.

Appendix B As Found Hazard Summary

During each physical assessment of regulated work, safety officers identify hazards found and rate the hazards in accordance with the scale below.

TABLE B-1: HAZARD RATING SCALE

Rating	Label	Description
0	COMPLIANT	*No hazards were observed during the assessment and the work was found to comply with the codes and regulations.*
1	INSIGNIFICANT	*These hazards are considered to be typical and are not considered to present a significant concern to safety. Duty holders are encouraged to improve so as to prevent these from being created as a result of their work.*
2	MINOR	
3	MODERATE	*These hazards are considered to present an appreciable concern to safety. The safety system is considered compromised if duty holders do not take steps to understand and prevent these hazards.*
4	MAJOR	*These hazards are known to present considerable safety risks. The safety system of qualified and licensed professionals working under permit to recognized codes and standards is considered to have failed when hazards of this nature are found.*
5	SEVERE	

The table below lists the SEVERE and MAJOR hazards recorded from October 1, 2014 to December 2014. The table is sorted by Industry Sector and Hazard Rating. SEVERE and MAJOR hazards observed during Railways assessments and audits are excluded from this listing. SEVERE and MAJOR hazards observed during ASA assessments and audits are excluded from this listing but are discussed in the ASA section of this Report.

TABLE B-2: SEVERE AND MAJOR AS FOUND HAZARDS (OCTOBER 1, 2014 TO DECEMBER 31, 2014)

Industry Sector	Hazard Rating	Description
Boilers, PV, Refrigeration	MAJOR	This forced water circulation hot water boiler does not have code-required flow switch and high temperature cut off safety switch, and in the event of circulating pump failure, can lead to overheating and possible explosion.
Boilers, PV, Refrigeration	MAJOR	Hole in outer skin at lower hand hole allowing combustion gases to enter boiler room. This could lead to inhalation of combustion gases, with the risk of personal injury.
Electrical	MAJOR	Aerial high voltage bare conductors were not adequately protected. Bare 14,400 volt conductors over occupied mobile homes. Conductors were less than table 32 clearance requirements of 3.4 meters and a hazard to anyone on the roof. Unqualified persons were in the area.
Electrical	MAJOR	Safety switches wired in wrong orientation, line to load and load to line creating major safety risk. Electrical contractor sent an unqualified electrical worker without any supervision to perform this work. The FSR for this contractor did not attend the site and inspect the work prior to the installation being energized.
Electrical	MAJOR	High voltage gang operated load break switch does not have grounding electrodes and grounding conductors fully covered as required by code for grounding high voltage service.
Electrical	MAJOR	High voltage load break switch not grounded properly as copper wire is exposed and not covered. Equipment is not approved or does not have variance.
Electrical	MAJOR	Temporary construction service has service conductors too low to the ground,6x6 is installed inadequately and may fall over.
Electrical	MAJOR	Fire damages and lack of attention and maintenance have created unsafe conditions.
Electrical	MAJOR	The hazard was created by the combination of the loose connection of a branch circuit conductor at a 15 Amp rated circuit breaker and the possible overloading of the circuit by items plugged into the exterior receptacle. The insulation on the branch circuit conductor is melted inside the electrical panel. The hazard was considered to be thermal and the conductor was in contact with the panel and other branch circuit conductors inside the panel.
Electrical	MAJOR	Live hazardous exposed bus bars and conductors on service panel with cover missing. Unable to find or install panel cover. Live exposed hazardous conductors hanging from ceiling holding up luminaires.
Electrical	MAJOR	Open energized 120/240 volt panels, interconnection to temp power, installed by builder, unqualified people present, cable unprotected in general public area, large shock area present, 4 panels, energized loomex on floor, open splices.
Elevating Devices	MAJOR	Owner had created an instruction procedure on how to reset the elevator governor when tripped. Unlicensed and untrained persons could created an unsafe condition with a high risk and high likelihood of a serious injury and/or fatality.

TABLE B-2: SEVERE AND MAJOR AS FOUND HAZARDS (OCTOBER 1, 2014 TO DECEMBER 31, 2014)

Industry Sector	Hazard Rating	Description
Elevating Devices	MAJOR	It is important to maintain escalator steps as riders come in contact with them. We found numerous escalator steps which had broken or chipped step treads. The landing comb plates were also missing comb teeth. These conditions could lead to people tripping and falling or loss of limb.
Elevating Devices	MAJOR	It is important to maintain minimum clearances in the vicinity of escalator in particular handrails. We found a sprinkler pipe installed within the minimum clearance. This could lead to a shear point causing loss of limb.
Elevating Devices	MAJOR	It is important to understand that a car gate on a construction hoist needs to be verified closed before a car can leave a landing. We found that the car gate closed-position monitoring switch was not functioning. This led to the car operating with the ga open. When the construction hoist operates with the car gate open, riders could be exposed to both shearing and pinching points.
Elevating Devices	MAJOR	It is important to understand that on some handicap lifts a ramp is provided at the lower landing for a person in a wheelchair to access the lift. We found the ramp incorrectly installed and in the vicinity of a live electrical service. This could lead to a falling or tripping hazard which may cause contact with the electrical service causing shock.
Elevating Devices	MAJOR	Hydraulic elevators with griffin controllers may enter high speed when inching down (slow speed) on car top inspection operation. This is an identified issue and a safety order (SO) was issued to the industry. According to the SO a warning signage was to be posted on car top informing the mechanics about this hazard. During the inspection it was found that no signage was posted. This could lead to the mechanic and his helper getting into a hazardous situation. The helper mechanic would be under the elevator car while the other mechanic is slowly lowering the car (inching), but the car could enter high speed and crush the helper mechanic.
Elevating Devices	MAJOR	Hydraulic elevators with griffin controllers may enter high speed when inching down (slow speed) on car top inspection operation. This is an identified issue and a safety order (SO) was issued to the industry. According to the SO a warning signage was to be posted on car top informing the mechanics about this hazard. During the inspection it was found that no signage was posted. This could lead to the mechanic and his helper getting into a hazardous situation. The helper mechanic would be under the elevator car while the other mechanic is slowly lowering the car (inching), but the car could enter high speed and crush the helper mechanic.
Elevating Devices	MAJOR	When an elevator stops at a landing the elevator car has to substantially flush with the landing floor surface. During the inspection it was observed that, on some stops, the elevator was landing 4-6" above the floor and on other stops it was landing 4-6" below the floor level. A tripping hazard exists for people entering or leaving the elevator car. This serious tripping hazard is further compounded by the fact that the elevator is in a building inhabited by elderly citizens.
Elevating Devices	MAJOR	When an elevator stops at a landing the elevator car has to substantially flush with the landing floor surface. During the inspection it was observed that, on some stops, the elevator was landing 4-6" above the floor and on other stops it was landing 4-6" below the floor level. A tripping hazard exists for people entering or leaving the elevator car. This serious tripping hazard is further compounded by the fact that the elevator is in a building inhabited by elderly citizens.
Elevating Devices	MAJOR	The mechanical safeties on an elevator provide a safe stop for the passengers in the event of an overspeeding descending elevator car. The safeties can only be released with the upward movement of the car. During an acceptance inspection it was found the safeties did not disengage/reset when the car was moved in the upward direction. Upon further investigation, it was found that the release carriage on the safety device was damaged. This would lead to the safeties not engaging in an overspeed condition. Safeties were not adjusted properly by the manufacturer.
Elevating Devices	MAJOR	Tables are used in high-rise construction to erect buildings. During an inspection of a construction personnel hoist (a temporary elevator attached to the exterior of the building used to transport trades vertically), the contractor wanted to remove the table from above the hoist during operation. When any loads or material being lowered, raised or moved are within a 10-foot vicinity of the hoist, the hoist must be parked at the bottom landing with no persons in or on the ground level deck. Potentially if the load was to shift or fall, the falling material could cause catastrophic damage to equipment, injury and death. The general contractor did not follow Worksafe Policy and Procedure for when flying loads over personnel.
Elevating Devices	MAJOR	The landing gate (door) has a gate lock. This gate lock mechanically keeps the gate from opening as well there is an electrical switch component to the gate lock which will stop the construction elevator from moving when opened. During an acceptance inspection it was found that the top landing gate electrical switch was not connected. This condition would allow the construction elevator to continue running with the top landing gate possibly being physically open. This would create a serious/fatal shearing hazard as well as a fatal fall hazard. It was found the installing contractor had neglected to connect the electrical switch.
Elevating Devices	MAJOR	Safeties failed. Car safeties are key components for stopping an elevator if the elevator brakes and/or frequency drive fail to control and stop an electric elevator. During inspection of the elevator modernization, full load weight was placed in the elevator to simulate an overspeed situation in the down direction. When the elevator safeties engaged they did not perform to code requirements and failed to stop and hold the car. In real time if this was to occur the elevator would crash into the pit causing major damage, injuries and could potentially cause a fatality.

Appendix B As Found Hazard Summary Continued

TABLE B-2: SEVERE AND MAJOR AS FOUND HAZARDS (OCTOBER 1, 2014 TO DECEMBER 31, 2014)

Industry Sector	Hazard Rating	Description
Elevating Devices	MAJOR	The car safety mechanism switch shall operate before or at the time of application of the car safety. During an acceptance inspection it was found that the switch activation arm was bent upon safety application. This caused the switch not to activate, this switch prevents severe damage caused by a running drive machine after safety set. Continued operation of the driving machine can sever the ropes or wear the drive sheave. Further investigation is required to determine if the cause is due to design flaw combined with installation adjustment.
Elevating Devices	MAJOR	The car safety mechanism switch shall operate before or at the time of application of the car safety. During an acceptance inspection it was found that the switch activation arm was bent upon safety application. This caused the switch not to activate, this switch prevents severe damage caused by a running drive machine after safety set. Continued operation of the driving machine can sever the ropes or wear the drive sheave. Further investigation is required to determine if the cause is due to design flaw combined with installation adjustment.
Elevating Devices	MAJOR	The governor rope is used to engage the mechanical safeties on an elevator to provide a safe stop for the passengers in the event of an overspeeding descending elevator car. During a major alteration inspection it was found that the governor rope was in a condition that it may break and needed replacement. This condition could cause the elevator car to crash into the buffers causing severe injuries to passengers riding the elevator. It was found that this was not noticed by the installing/maintaining elevator contractor.
Elevating Devices	MAJOR	Normal Terminal Slowdown Device (NTSD) is a device that is a back-up device to the normal slow down means at the terminal landings. During inspection, it was found that the NTSD function did not work. Failure to operate causes excessive deceleration at terminal landings and contact with the buffers which can cause injury to passengers in elevator.
Elevating Devices	MAJOR	Elevator safeties (undercar brakes)are supposed to stop within predetermined limits. During inspection and testing it was found that the deceleration rate was too great and would stop the car outside the permitted range. This would cause an extremely harsh stop which would cause serious injury to passengers in the elevator.
Gas	SEVERE	The contractor has installed a used 'Revent' oven and there is no indication that there has been compliance with the issued safety order.
Gas	SEVERE	The gas safety officer found a natural gas meter installed without vehicle crash protection installed in a very high traffic area. Damage to the gas meter or house piping could result in an uncontrolled and unsafe release of natural gas. The gas meter is attached to a high occupancy building which includes a gas station, convenience store, restaurant, bus depot, and dwelling units. Gas station staff indicated that the gas meter had suffered previous damage from a vehicle, and the meter was repaired by the gas utility. No vehicle protection was installed following the original damage.
Gas	SEVERE	The appliance was not vented to the outdoors and possible negative pressure conditions were created by the furnace being enclosed in a closet and drawing return air and combustion air from the same space. This allowed flue gases (which contain carbon monoxide) to be drawn back into the interior of the building. The appliance has most likely been installed incorrectly since the beginning but certain structural renovations such as the closet enclosure which houses the furnace and a secondary roof installed on the building have created much worse operating conditions.
Gas	SEVERE	A gas safety inspection was performed on a three-storey addition under construction directly attached to an occupied nursing care home. The windows of the nursing home are located inside the addition building. There were also construction workers inside the building at the time of inspection. Three certified temporary direct fired gas fired heaters were attached to the gas line on each floor of the addition. The three regulators supplying gas to the heaters were equipped with an internal relief vent which terminated inside the building, directly beside the three operating gas heaters. Should a gas regulator over-pressure relief vent open (as the regulators are designed to do), a possible uncontrolled release of gas could occur inside the building. The gas heaters in close proximity to the regulator vents are a source of ignition within the building. This could result in a fire or explosion in a high occupancy area with workers present. Any type of explosion would also likely blow the glass windows into the attached occupied nursing home and involve the nursing home staff and patients in any explosion or fire situation.
Gas	SEVERE	During inspection of a new home under construction, it was observed that the gas supply was connected, and the furnace was turned on but would not ignite correctly. The special plastic vent was not secured to the furnace. Because the vent was not secured to the furnace, the safety officer witnessed the general contractor dislodge the furnace vent and combustion air piping and allow the furnace to operate with the vent products entering the home. There were no carbon monoxide detectors installed in the home to provide a warning. Building occupants could be overcome by furnace vent products entering the home.
Gas	SEVERE	A building was totally enclosed in plastic for construction. Workers were present inside the building enclosure. A gas meter and regulator assembly, and an operating gas fired temporary heater were installed inside the building enclosure. If the gas regulator vent were to open, gas could fill the area and be ignited by the operating gas heater. A fire or explosion could occur.
Gas	MAJOR	Gas regulator relief vent termination needs to be pointing down to prevent the entry of water.
Gas	MAJOR	Water heater connected with a 3/8" by 50' roll of hose that is not approved for use with propane gas. It is also not acceptable to connect a gas appliance with a 50' hose even if it was approved it is undersized and the water heater will be under-fired.
Gas	MAJOR	Underground gas lines terminating under enclosed mobile home skirting; 2 RV units furnace fuel conversions and commissioning by unqualified individual; mobile home special venting system not installed to manufacturers instruction shop water heater not installed according to installation instructions causing a hazard

TABLE B-2: SEVERE AND MAJOR AS FOUND HAZARDS (OCTOBER 1, 2014 TO DECEMBER 31, 2014)

Industry Sector	Hazard Rating	Description
Gas	MAJOR	Clearance to appliance exhaust termination/regulator relief not met.
Gas	MAJOR	Hotsy pressure washer shut down by on site operator. The operator complained to gas safety officer about a very aggressive burner ignition after several minutes of appliance operation. Continued use of the appliance (burner) could damage the appliance or cause harm to a person operating the pressure washer.
Gas	MAJOR	The large full relief regulator (5psig) in the ceiling of the underground parkade is vented along the ceiling of the parkade to the exterior of the building using 2" white PVC. This material is not approved for venting regulators as it can be compromised in a fire. Plastic pipe has been known to create a static electrical charge on the pipe when gas flows through the plastic pipe which can ignite the gas exiting the pipe.
Gas	MAJOR	The gas safety officer identified a full internal relief type second stage propane regulator (10 pound inlet pressure, 1/2 pound outlet pressure) mounted on the side of a new single family dwelling. The regulator overpressure relief vent opening terminated one foot away from a source of ignition (air conditioning unit). The gas code requires a minimum of 10 feet clearance from the regulator relief vent to a source of ignition. Should the regulator relief valve open to relieve an overpressure condition in the gas piping system (as the regulator is designed to do), an uncontrolled amount of propane gas could escape, potentially causing a fire or explosion due to the proximity of the electrical equipment.
Gas	MAJOR	The two gas system regulators to the IBC boilers have their regulator vents connected to an existing regulator stack where two full relief regulators have also been connected. The full relief regulators are designed to relieve any excess gas pressure in excess of the regulators set point. This excess pressure in the regulator relieve vent stack may result in the top loading or pressurizing of the top of another regulators diaphragm which may cause the faulty operation of the regulator. This has the potential to cause a gas supply overpressure condition at a boiler or other gas appliance connected to the gas system creating a fire or explosion.
Gas	MAJOR	No combustion air has been provided for the appliances and there was an unplugged opening in the chimney. The lack of combustion air could cause a negative pressure in the room and prevent the hot water tank from venting properly and the opening in the chimney could allow for flue gasses to enter the home. These hazards were caused by a lack of attention by the installer.
Gas	MAJOR	Uncertified ,unvented, propane fueled catalytic heater in use with-in the dwelling unit. There is a very high risk of carbon monoxide exposure with the use of unvented appliance inside a dwelling unit.
Gas	MAJOR	Appliance limits or safeties cannot be rendered inoperative or bypassed. After a review of the appliance and building controls, the safety officer found a potential risk of unsafe overheating. This could lead to a condition where the heat will stay on indefinitely without a fan running; causing a risk of overheating or fire at the school.
Gas	MAJOR	The exhaust portion of an appliance vent shall be assembled and securely fastened through the use of an adhesive, screws or an approved connector at all times. During assessment, the exhaust portion of the pvc plastic venting was found not securely fastened to the furnace's exhaust collar. The plastic vent pipe was inserted into the collar but no adhesive was used. Uncontrolled appliance vent gases could affect an appliances operation and may be harmful to persons if exposed to while in an enclosed environment.
Gas	MAJOR	A future commercial kitchen has an open 1/2" gas line connected to live fuel supply protected only by a shut-off valve and fire valve. This presents a potential gas leak and explosion if shut-off valve was opened.
Gas	MAJOR	A 1000 USG propane tank on active construction site supplying propane to temporary heater has liquid outlet on bottom of tank controlled only by ISC valve and a ball valve (both in closed position) but open ended downstream of ball valve. Opening of the valves would result in release of liquid propane. This could result in freeze burn to anyone attempting to shut valve off, or potential fire if ignition occurred.
Gas	MAJOR	The fuel supply was connected to a boiler with no vent. If an un-vented boiler were to be energized, it would exhaust the products of combustion (potentially containing levels of carbon monoxide) directly into the building. The hazards have most likely been created by unqualified individuals performing these installations.
Gas	MAJOR	Upon inspection of the mechanical room in a renovated house, the single wall vent connector from the boiler and water heater were in direct contact with combustible material. Single wall vent connectors require a 6" clearance to combustibles. Combustible material in direct contact with the high heat of a single wall vent connector can result in a fire within the structure. The newly enclosed mechanical room in the basement of the renovated house was lacking an adequate air supply for the proper operation of the gas fired equipment. Inadequate air supply to gas fired equipment may result in incomplete combustion which can be a contributing factor to the generation of carbon monoxide in the home. The newly enclosed mechanical room in basement of renovated house was lacking the adequate clearance to combustibles from the rear of the boiler. The boiler manufacturer calls for 7" of clearance to combustible from the rear of the unit. The new wall only provided 3" of clearance to combustible material. The lack of adequate clearance to combustibles from the rear of the boiler results in a elevated fire hazard.
Gas	MAJOR	Health Canada, the United States Consumer Product Safety Commission (US CPSC) and Daesung Celtic Energy issue a joint recall for tankless gas water heaters. Four Daesung Quietside water heaters that have a manufacturers recall that required removing them from service were identified. The water heaters can overheat, posing a fire hazard.

Appendix C Enforcement Actions

A Compliance Order is an enforcement document issued to a person by BC Safety Authority that specifies actions to be taken, stopped, or modified where, in the opinion with BC Safety Authority, there exists a risk of personal injury or damage to property associated with work or products regulated by the *Safety Standards Act*. The following compliance orders were issued in 2014.

Note 1:
BC Safety Authority is subject to the ***Freedom of Information and Protection of Privacy Act****. Provincial legislation restricts the information that may be published with respect to individuals. Accordingly, BC Safety Authority may provide descriptions of enforcement actions taken but may not identify individuals by name.*

Table C-1: Compliance Orders

INDUSTRY SECTOR	COMPLIANCE ORDER N°.	ISSUED TO [NOTE 1]	DUTY HOLDER HAS LICENCE OR QUALIFICATION	CATEGORY	DESCRIPTION
Amusement Rides	CO-2014-0025	SPLASHDOWN WATERPARKS INC.	Yes	Outstanding non-compliance(s)	Amusement device physical assessments identified a non-compliance with respect to a number of amusement devices intended for operation at the duty holder's facility. The non-compliance identified required the manufacturer to provide a letter confirming safety of the device prior to operation. The duty holder did not respond to this requirement and subsequently put the devices into operation.
Boilers and Pressure Vessels	CO-2014-0009	FINK MACHINE INC.	No	No contractor license	A boiler physical assessment found that regulated boiler and pressure vessel work had been performed where a permit had not been obtained. The work identified involved the installation of a biomass hot water boiler and other pressure vessels. The duty holder was identified as being responsible for the work found and did not possess a boiler contractor's license as required for this purpose.
Boilers and Pressure Vessels	CO-2014-0033	AN INDIVIDUAL	No	No contractor license	A boiler physical assessment found that regulated boiler and pressure vessel work had been performed where a permit had not been obtained. The work identified involved the installation of two boilers for a heating system. The duty holder was identified as being responsible for the work found and did not possess a boiler contractor's license as required for this purpose.
Electrical	CO-2014-0002	A.A.R. WEST COAST ENTERPRISES LTD.	No	No contractor license	An electrical physical assessment found regulated electrical work that had been performed where a permit had not been obtained. The work identified involved the removal of electrically connected regulated products. The duty holder was identified as being responsible for this work and did not possess an electrical contractor's license as required for this purpose.
Electrical	CO-2014-0003	AN INDIVIDUAL	Yes	Failure to request inspection	An electrical physical assessment found electrical work that had been performed. The duty holder was identified as being responsible for the performance of this work. The work identified involved the installation of electrical service equipment and rough wiring. The service equipment had been connected to the utility supply system and the rough wiring had been concealed. No evidence of a request for inspection having been submitted in either case was found at the time of inspection.
Electrical	CO-2014-0004	AN INDIVIDUAL	No	No contractor license	An electrical physical assessment found regulated electrical work that had been performed where a permit had not been obtained. The work identified involved the installation of new wiring and other regulated electrical equipment for a water system installed at this location. The duty holder was identified as being responsible for the work found and did not possess an electrical contractor's license as required for this purpose.
Electrical	CO-2014-0005	AN INDIVIDUAL	No	No contractor license	An electrical physical assessment found regulated electrical work that had been performed where a permit had not been obtained. The work identified involved the installation of new wiring and other regulated electrical equipment. The duty holder was identified as being responsible for the work found and did not possess an electrical contractor's license as required for this purpose.
Electrical	CO-2014-0006	ABLE ENTERPRISES LTD.	No	No contractor license	An electrical physical assessment found regulated electrical work that had been performed where a permit had not been obtained. The work identified involved the repair of existing overhead wiring. The duty holder was identified as being responsible for the work found and did not possess an electrical contractor's license as required for this purpose.
Electrical	CO-2014-0008	WAGNER HEATING & AIR LTD.	No	No contractor license	An electrical physical assessment found regulated electrical work that had been performed where a permit had not been obtained. The work identified involved the installation of new wiring for electrical heating/cooling equipment. The duty holder was identified as being responsible for the work found and did not possess an electrical contractor's license as required for this purpose.

Table C-1: Compliance Orders

INDUSTRY SECTOR	COMPLIANCE ORDER N°.	ISSUED TO [NOTE 1]	DUTY HOLDER HAS LICENCE OR QUALIFICATION	CATEGORY	DESCRIPTION
Electrical	CO-2014-0010	NIGHTINGALE ELECTRICAL LTD.	Yes	Failure to report an incident	Upon receipt of a report indicating that an incident had occurred, an incident investigation was subsequently performed. The investigation determined that an incident had occurred involving a regulated product that was being worked on at the time by an employee of the duty holder. No evidence was found to indicate that the incident had been reported to the BC Safety Authority within the period of time as specified.
Electrical	CO-2014-0011	CUTTING EDGE SECURITY SYSTEMS INC.	Yes	No Permit	An electrical physical assessment found regulated electrical work that had been performed. The work identified involved the installation of wiring and other electrical equipment. The duty holder was identified as having been responsible for the performance of the work. No evidence of an electrical permit having been obtained for the work was found at the time of inspection.
Electrical	CO-2014-0012	HANCON CONSTRUCTORS LTD.	No	No contractor license	An electrical physical assessment found regulated electrical work that had been performed where a permit had not been obtained. The work identified involved the removal of installed regulated electrical equipment. The duty holder was identified as being responsible for the work found and did not possess an electrical contractor's license as required for this purpose.
Electrical	CO-2014-0014	AN INDIVIDUAL	No	No contractor license	An electrical physical assessment found regulated electrical work that had been performed where a permit had not been obtained. The work identified involved the alteration of regulated electrical equipment. The duty holder was identified as being responsible for the work found and did not possess an electrical contractor's license as required for this purpose.
Electrical	CO-2014-0015	AN INDIVIDUAL	No	No contractor license	An electrical physical assessment found regulated electrical work that had been performed where a permit had not been obtained. The work identified involved the installation of new wiring and other regulated electrical equipment. The duty holder was identified as being responsible for the work found and did not possess an electrical contractor's license as required for this purpose.
Electrical	CO-2014-0016	ECO SMART HEATING & COOLING INC.	No	No contractor license	An electrical physical assessment found regulated electrical work that had been performed where a permit had not been obtained. The work identified involved the installation of electrical wiring for connection of a new heating system. The duty holder was identified as being responsible for the work found and did not possess an electrical contractor's license as required for this purpose.
Electrical	CO-2014-0017	AN INDIVIDUAL	No	No contractor license	An electrical physical assessment found regulated electrical work that had been performed where a permit had not been obtained. The work identified involved the installation of electrical wiring for an outdoor low voltage lighting system. The duty holder was identified as being responsible for the work found and did not possess an electrical contractor's license as required for this purpose.
Electrical	CO-2014-0018	EN INVESTMENTS GROUP LTD.	Yes	Use of unqualified workers	An electrical physical assessment found that an unapproved electric exterior sign had been installed without necessary permissions. The installation of this equipment is regulated electrical work that requires a permit and that must be performed by qualified workers. The duty holder performed regulated work without a permit using an unqualified worker to perform the work.
Electrical	CO-2014-0019	AN INDIVIDUAL	No	Tampering or unsafe use of regulated equipment	An electrical physical assessment found that electrical wiring and equipment had been installed with exposed live connections and unsecured equipment. The regulated electrical work had been performed in a manner that left an unsafe condition. The duty holder performed unsafe electrical work.
Electrical	CO-2014-0020	ZISKOS SIGN CONSULTING LTD.	Yes	Sale of uncertified equipment	An electrical physical assessment found that an unapproved electric exterior sign had been installed. The sign is regulated electrical equipment and requires an approval mark. The duty holder was identified as the supplier of the unapproved sign.
Electrical	CO-2014-0021	U.P.W. TREATMENT SYSTEMS LTD.	No	Expired contractor license	An electrical physical assessment found regulated electrical work that had been performed where a permit had not been obtained. The work identified involved the installation of regulated electrical equipment associated with a residential water system. The duty holder was identified as being responsible for this work and did not possess a valid electrical contractor's license as required for this purpose.

Appendix C Enforcement Actions Continued

Table C-1: Compliance Orders

INDUSTRY SECTOR	COMPLIANCE ORDER N°.	ISSUED TO [NOTE 1]	DUTY HOLDER HAS LICENCE OR QUALIFICATION	CATEGORY	DESCRIPTION
Electrical	CO-2014-0022	0904607 BC LTD.	No	No contractor license	An electrical physical assessment found regulated electrical work that had been performed where a permit had not been obtained. The work identified involved the installation of new wiring and other regulated electrical equipment. The duty holder was identified as being responsible for the work found and did not possess an electrical contractor's license as required for this purpose.
Electrical	CO-2014-0023	AN INDIVIDUAL	No	No contractor license	An electrical physical assessment found regulated electrical work that had been performed where a permit had not been obtained. The work identified involved the installation of new wiring and other regulated electrical equipment. The duty holder was identified as being responsible for the work found and did not possess an electrical contractor's license as required for this purpose.
Electrical	CO-2014-0026	RELIANCE PROTECTRON INC.	Yes	No Permit	An electrical physical assessment found regulated electrical work that had been performed. The work identified involved the installation of wiring and other electrical equipment. The duty holder was identified as having been responsible for the performance of the work. No evidence of an electrical permit having been obtained for the work was found at the time of inspection.
Electrical	CO-2014-0029	AN INDIVIDUAL	No	Outstanding non-compliance(s)	An electrical physical assessment identified a non-compliance with respect to existing regulated electrical equipment. The non-compliance identified involved the duty holder's electrical service. The duty holder failed to respond to safety officer notifications stipulating a deadline for compliance.
Electrical	CO-2014-0030	AN INDIVIDUAL	No	No contractor license	An electrical physical assessment found regulated electrical work that had been performed where a permit had not been obtained. The work identified involved the installation of new wiring and other regulated electrical equipment. The duty holder was identified as being responsible for the work found and did not possess an electrical contractor's license as required for this purpose.
Electrical	CO-2014-0034-A01	FORTISBC INC.	No	Provide records	The duty holder had been initially requested to provide specific information to BCSA related to customer electricity consumption. The information was required in order to enable BCSA to identify operating permit avoidance and mitigate associated safety risks. Though further efforts were made with the intention of bringing about voluntary compliance, the duty holder chose not to submit the information to BCSA.
Electrical	CO-2014-0037	AN INDIVIDUAL	No	Outstanding non-compliance(s)	An electrical physical assessment identified non-compliances with respect to existing regulated electrical equipment. The non-compliances identified involved regulated equipment that had been installed for use with an agricultural irrigation system. The duty holder failed to respond to safety officer notifications stipulating a deadline for compliance.
Electrical	CO-2014-0039	PROCOM ELECTRIC INC.	Yes	Use of unqualified workers	An electrical physical assessment found regulated electrical work being performed under a permit that had been obtained by a licensed contractor. The work involved new wiring and other electrical equipment being installed in an existing building. At the time of inspection, several workers were found performing this work. When requested by the safety officer, none of these workers were able to provide evidence of qualification for the type of work being performed in each circumstance.
Electrical	CO-2014-0040	SEA TO SKY SECURITY (2008) LTD.	No	Expired contractor license	An electrical physical assessment found regulated electrical work that had been performed where a permit had not been obtained. The work identified involved the installation of new wiring for a security alarm system. The duty holder was identified as being responsible for this work and did not possess a valid electrical contractor's license as required for this purpose.
Electrical	CO-2014-0041	HOLMES ELECTRIC LTD.	Yes	No Permit	An electrical physical assessment found regulated electrical work that had been performed. The work identified involved the installation of wiring and other electrical equipment. The duty holder was identified as having been responsible for the performance of the work. No evidence of an electrical permit having been obtained for the work was found at the time of inspection.
Electrical	CO-2014-0055	AN INDIVIDUAL	Yes	Tampering or unsafe use of regulated equipment	An electrical physical assessment found that electrical wiring and equipment had been installed with exposed live connections and unsecured equipment. The regulated electrical work had been performed in a manner that left an unsafe condition. The duty holder performed unsafe electrical work.

Appendix C

Table C-1: Compliance Orders

INDUSTRY SECTOR	COMPLIANCE ORDER N°.	ISSUED TO [NOTE 1]	DUTY HOLDER HAS LICENCE OR QUALIFICATION	CATEGORY	DESCRIPTION
Electrical	CO-2014-0056	AN INDIVIDUAL	No	No contractor license	An electrical physical assessment found regulated electrical work that had been performed where a permit had not been obtained. The work identified involved the installation of new wiring and other regulated electrical equipment. The duty holder was identified as being responsible for the work found and did not possess an electrical contractor's license as required for this purpose.
Electrical	CO-2014-0057	JACO POWERLINES LTD.	No	Expired contractor license	An electrical physical assessment found regulated electrical work that had been performed where a permit had not been obtained. The work identified involved the installation of a primary powerline. The duty holder was identified as being responsible for this work and did not possess a valid electrical contractor's license as required for this purpose.
Electrical	CO-2014-0060	AN INDIVIDUAL	Yes	Use of unqualified workers	An electrical physical assessment found regulated electrical work being performed under a permit that had been obtained by a licensed contractor. The work involved new wiring and other electrical equipment being installed in an existing building. At the time of inspection, several workers were found performing this work. When requested by the safety officer, none of these workers were able to provide evidence of qualification for the type of work being performed in each circumstance.
Elevating Devices	CO-2014-0007	CANFOR PULP LTD.	No	Tampering or unsafe use of regulated equipment	Upon receipt of a report identifying an unsafe condition related to regulated elevating equipment, an incident investigation was subsequently performed. The investigation determined that a safety device in use with the elevating equipment had been made inoperable. As such, this created an unsafe condition in respect to the operation of the elevating equipment in this circumstance.
Elevating Devices	CO-2014-0035	OTIS CANADA INC.	Yes	Provide records	An investigation determined that the duty holder had not been providing specific safety related information to BCSA. The information is required for purposes of allowing BCSA to provide proper regulatory oversight for certain types of elevating devices.
Gas	CO-2014-0001	AN INDIVIDUAL	No	Expired contractor license	A gas physical assessment found regulated gas work that had been performed where a permit had not been obtained. The work identified involved the installation of regulated gas equipment. The duty holder was identified as being responsible for this work and did not possess a valid gas contractor's license as required for this purpose.
Gas	CO-2014-0013	AN INDIVIDUAL	No	No contractor license	A gas physical assessment found regulated gas work that had been performed where a permit had not been obtained. The work identified involved the installation of regulated gas equipment. The duty holder was identified as being responsible for this work and did not possess a gas contractor's license as required for this purpose.
Gas	CO-2014-0024	AN INDIVIDUAL	No	No contractor license	A gas physical assessment found regulated gas work that had been performed where a permit had not been obtained. The work identified involved the installation of piping for regulated gas equipment. The duty holder was identified as being responsible for this work and did not possess a gas contractor's license as required for this purpose.
Gas	CO-2014-0027	MOUNTAIN VIEW INDUSTRIES LTD.	No	No contractor license	Gas physical assessments found regulated gas work that had been performed where permits had not been obtained. The work identified involved the installation of regulated gas equipment at three separate locations. The duty holder was identified as being responsible for this work and did not possess a gas contractor's license as required for this purpose.
Gas	CO-2014-0028	AN INDIVIDUAL	No	No contractor license	A gas physical assessment found regulated gas work that had been performed where a permit had not been obtained. The work identified involved the installation of regulated gas equipment. The duty holder was identified as being responsible for this work and did not possess a gas contractor's license as required for this purpose.
Gas	CO-2014-0031	AN INDIVIDUAL	No	No contractor license	A gas physical assessment found regulated gas work that had been performed where a permit had not been obtained. The work identified involved the installation of a commercial gas dryer. The duty holder was identified as being responsible for this work and did not possess a gas contractor's license as required for this purpose.

Appendix C Enforcement Actions Continued

Table C-1: Compliance Orders

INDUSTRY SECTOR	COMPLIANCE ORDER N°.	ISSUED TO [NOTE 1]	DUTY HOLDER HAS LICENCE OR QUALIFICATION	CATEGORY	DESCRIPTION
Gas	CO-2014-0032	AN INDIVIDUAL	No	No contractor license	A gas physical assessment found regulated gas work that had been performed where a permit had not been obtained. The work identified involved the installation of a propane gas supply system for a new modular home. The duty holder was identified as being responsible for this work and did not possess a gas contractor's license as required for this purpose.
Gas	CO-2014-0036	AN INDIVIDUAL	No	Expired contractor license	A gas physical assessment found regulated gas work that had been performed where a permit had not been obtained. The work identified involved the installation of regulated gas equipment for providing supply to two boilers installed for a heating system. The duty holder was identified as being responsible for this work and did not possess a valid gas contractor's license as required for this purpose.
Gas	CO-2014-0038	452702 BC LTD.	No	Sale of uncertified equipment	A gas physical assessment found that an unapproved gas fireplace had been installed. The fireplace is regulated gas equipment and requires an approval mark. The duty holder was identified as the supplier of the unapproved fireplace.
Gas	CO-2014-0042	AN INDIVIDUAL	No	Expired contractor license	A gas physical assessment found regulated gas work that had been performed where a permit had not been obtained. The work identified involved the installation of regulated gas equipment for providing supply to a boiler installed for a swimming pool heating system. The duty holder was identified as being responsible for this work and did not possess a valid gas contractor's license as required for this purpose.
Gas	CO-2014-0043	AN INDIVIDUAL	No	No contractor license	A gas physical assessment found regulated gas work that had been performed where a permit had not been obtained. The work identified involved the installation of a new gas furnace and other regulated equipment in an existing home. The duty holder was identified as being responsible for this work and did not possess a gas contractor's license as required for this purpose.
Gas	CO-2014-0044	AN INDIVIDUAL	No	No contractor license	A gas physical assessment found regulated gas work that had been performed where a permit had not been obtained. The work identified involved the installation of a new gas furnace and other regulated equipment in a new home. The duty holder was identified as being responsible for this work and did not possess a gas contractor's license as required for this purpose.
Gas	CO-2014-0045	AN INDIVIDUAL	No	No contractor license	A gas physical assessment found regulated gas work that had been performed where a permit had not been obtained. The work identified involved the installation of a new gas furnace and other regulated equipment in an existing home. The duty holder was identified as being responsible for this work and did not possess a gas contractor's license as required for this purpose.
Gas	CO-2014-0046	R.D. MECHANICAL SYSTEMS LTD.	No	Expired contractor license	A gas physical assessment found regulated gas work that had been performed where a permit had not been obtained. The work identified involved the installation of a new gas fireplace and other regulated equipment in an existing home. The duty holder was identified as being responsible for this work and did not possess a valid gas contractor's license as required for this purpose.
Gas	CO-2014-0047	KING POOL & SPA SERVICES LTD.	Yes	No Permit	A gas physical assessment found regulated gas work that had been performed. The work identified involved the installation of gas pool heater and other gas equipment. The duty holder was identified as having been responsible for the performance of the work. No evidence of a gas permit having been obtained for the work was found at the time of inspection.
Gas	CO-2014-0048	ESSON PLUMBING & HEATING LTD.	Yes	Use of unqualified workers	A gas physical assessment found several gas appliances and other gas equipment had been installed without necessary permissions. The installation of this equipment is regulated gas work that requires a permit and that must be performed by qualified workers. The duty holder performed regulated work without a permit using an unqualified worker to perform the work.
Gas	CO-2014-0049	AN INDIVIDUAL	No	No contractor license	A gas physical assessment found regulated gas work that had been performed where a permit had not been obtained. The work identified involved the installation of a new gas furnace and other regulated equipment in a new home. The duty holder was identified as being responsible for this work and did not possess a gas contractor's license as required for this purpose.

Appendix C

Table C-1: Compliance Orders

INDUSTRY SECTOR	COMPLIANCE ORDER N°.	ISSUED TO [NOTE 1]	DUTY HOLDER HAS LICENCE OR QUALIFICATION	CATEGORY	DESCRIPTION
Gas	CO-2014-0050	AN INDIVIDUAL	No	No contractor license	A gas physical assessment found regulated gas work that had been performed where a permit had not been obtained. The work identified involved the installation of a new gas fireplace and other regulated equipment in an existing home. The duty holder was identified as being responsible for this work and did not possess a gas contractor's license as required for this purpose.
Gas	CO-2014-0051	AN INDIVIDUAL	No	No contractor license	A gas physical assessment found regulated gas work that had been performed where a permit had not been obtained. The work identified involved the installation of a new natural gas fired generator and other regulated equipment at this location. The duty holder was identified as being responsible for this work and did not possess a gas contractor's license as required for this purpose.
Gas	CO-2014-0052	AN INDIVIDUAL	No	No contractor license	A gas physical assessment found regulated gas work that had been performed where a permit had not been obtained. The work identified involved the connection of a new gas meter to a furnace in an existing home. The duty holder was identified as being responsible for this work and did not possess a gas contractor's license as required for this purpose.
Gas	CO-2014-0053	AN INDIVIDUAL	No	No contractor license	A gas physical assessment found regulated gas work that had been performed where a permit had not been obtained. The work identified involved the installation of a new gas furnace and other regulated equipment in an existing home. The duty holder was identified as being responsible for this work and did not possess a gas contractor's license as required for this purpose.
Gas	CO-2014-0054	AN INDIVIDUAL	Yes	No Permit	A gas physical assessment found regulated gas work that had been performed. The work identified involved the installation of several gas appliances and other gas equipment. The duty holder was identified as having been responsible for the performance of the work. No evidence of a gas permit having been obtained for the work was found at the time of inspection.
Gas	CO-2014-0058	OMNI GAS LTD.	Yes	Outstanding non-compliance(s)	Gas physical assessments identified non-compliances with respect to existing regulated gas equipment. The non-compliance identified in each circumstance was the requirement to install an approved backsplash unit for use with an installed gas cook top appliance. The duty holder failed to respond to safety officer notifications stipulating a deadline for compliance.
Gas	CO-2014-0059	AN INDIVIDUAL	No	No contractor license	A gas physical assessment found regulated gas work that had been performed where a permit had not been obtained. The work identified involved the connection of a new gas furnace and other regulated equipment in a new home. The duty holder was identified as being responsible for this work and did not possess a gas contractor's license as required for this purpose.

Appendix C Enforcement Actions Continued

A sanction is an administrative penalty levied by a safety manager to correct non-compliant behaviour. The following sanctions were imposed by BC Safety Authority in 2014.

Note 1:
*BC Safety Authority is subject to the **Freedom of Information and Protection of Privacy Act**. Provincial legislation restricts the information that may be published with respect to individuals. Accordingly, BC Safety Authority may provide descriptions of enforcement actions taken but may not identify individuals by name.*

Table C-2: Sanctions

INDUSTRY SECTOR	TYPE	NUMBER	ISSUED TO [NOTE 1]	DUTY HOLDER HAS LICENCE OR QUALIFICATION	CATEGORY	DESCRIPTION
Electrical	Monetary Penalty	MP-2013-0010-A01	OK MOTEL & MOBILE HOME PARK LTD.	No	Failure to comply with a compliance order	A $2,500 monetary penalty was imposed on the duty holder for failure to comply with a compliance order.
Gas	Monetary Penalty	MP-2013-0015	AN INDIVIDUAL	No	Performing regulated work without the required permission	A $4,000 monetary penalty was imposed on the duty holder for performing regulated work without the required certificate of qualification, permit or permission.
Elevating Devices	Monetary Penalty	MP-2014-0001-A01	THYSSENKRUPP ELEVATOR (CANADA) LTD.	Yes	Failure to comply with a safety order	A $25,000 monetary penalty was imposed on the duty holder for failure to comply with a safety order.
Gas	Monetary Penalty	MP-2014-0002	AN INDIVIDUAL	No	Failure to comply with a compliance order	A $10,000 monetary penalty was imposed on the duty holder for failure to comply with a compliance order.
Electrical	Monetary Penalty	MP-2014-0003	1408168 ONTARIO INC.	Yes	Failure to comply with a compliance order	A $1,000 monetary penalty was imposed on the duty holder for failure to comply with a compliance order.
Electrical	Monetary Penalty	MP-2013-0010	OK MOTEL & MOBILE HOME PARK LTD.	No	Failure to comply with a compliance order	A $5,000 monetary penalty was imposed on the duty holder for continued failure to comply with a compliance order.
Electrical	Monetary Penalty	MP-2014-0004	BELCO HOLDINGS INC.	No	Failure to comply with a compliance order	A $5,000 monetary penalty was imposed on the duty holder for failure to comply with a compliance order.
Electrical	Monetary Penalty	MP-2014-0005	AN INDIVIDUAL	No	Failure to comply with a compliance order	A $750 monetary penalty was imposed on the duty holder for failure to comply with a compliance order.
Elevating Devices	Discipline Order	DO-2014-0001	A COMPANY	Yes	Failure to comply with a safety order and compliance order	A discipline order was imposed on the duty holder for failure to comply with both a safety order and a compliance order. The safety manger attached specific restrictions and conditions onto the duty holder's contractor licence subsequent to assessment of the contractor's performance.

Regulatory Instruments & Amendments

Appendix D

BC Safety Authority uses certain regulatory instruments to assist with the administration of the *Safety Standards Act* and the *Railway Safety Act*.

- Safety Orders are issued to prevent or reduce the risk of personal injury or damage to property. Compliance is mandatory.
- Directives are instruments that clarify or provide new interpretation of a regulation or code. Compliance is mandatory.
- Information bulletins provide helpful information and clarification on existing regulations or codes.

This appendix provides details regarding the Safety Orders, Directives and Information Bulletins issued by BC Safety Authority in 2014. Regulatory amendments are also included in this listing.

Table D-1: Listing of Regulatory Instruments and Amendments

INDUSTRY SECTOR	INSTRUMENT TYPE	ISSUE DATE	DOCUMENT NO.	TITLE	DESCRIPTION
Elevating Devices	Safety Order	February 17, 2014	SO-ED 2014-01	Mandatory Requirements For Removing Elevating Devices From Service	This safety order was issued to elevating device owners. The order describes technical requirements and procedures that must be followed when removing elevating devices from service, either permanently or temporarily, or when an elevating device is being dismantled. It also describes the rules that must be followed when a temporarily shut down elevating device is brought back into service.
Elevating Devices	Safety Order	February 17, 2014	SO-ED 2014-02	Firefighters Key Switch	This safety order was issued to all owners of elevators equipped with Firefighters' Emergency Operation (FEO) functions that were installed prior to the adoption of the 2007 edition of the CSA B-44 Safety Code for Elevators and Escalators in BC. The order requires that all elevators in BC with FEO functions be adapted to use a universal key as opposed to the dozens of keys that were previously used. This will greatly enhance the ability of emergency responders to use elevators in emergency situations.
Elevating Devices	Directive	February 17, 2014	D-ED 2014-01	Escalator Step/Skirt Performance Index Field Testing	This directive explains requirements in the elevator code for new and existing escalators with respect to the performance testing of step/skirt performance parameters and procedures. It further specifies procedures to be followed should an escalator be involved in a skirt entrapment incident.
Elevating Devices	Directive	February 17, 2014	D-ED 2014-02	Use of Jumpers	This directive provides requirements that elevating device contractors must follow when using temporary jumper cables and clips when conducting work on elevating devices.
Elevating Devices	Directive	January 8, 2014	D-L4 110803 5 Revision 04	Major and Minor Alterations	Update of directive issued to all licensed elevating devices contractors to clarify requirements 25 of the EDSR regarding Submission and Filing of Technical Information Documents for major or minor alteration of an existing elevating device.
Elevating Devices	Directive	May 30, 2014	D-L4 110303 3 Revision 1	Completion of Non Compliances	Update of directive specifying the forms to be used and the method to notify BCSA when non-compliances are complete.
Gas	Directive	March 18, 2014	D-GA 2014-01	*Safety Standards Act* & Gas Regulation – Liquid Natural Gas Dispensing Site Requirements	This directive provides the requirements that must be followed prior to a LNG dispensing site (i.e., similar to a gas station – LNG is dispensed to vehicles and used as a fuel) being installed. It also specifies the requirements that must be met once BC Safety Authority has accepted the design submission for a LNG dispensing site.
Gas	Directive	July 18, 2014	D-GA 2014-02	Mobile Outdoor Food Service Equipment Gas Approval Requirements	This directive provides details on gas approval requirements for hotdog carts, food trucks, concession trailers, and mobile hazmat/special purpose trailers built or brought into the province.
Gas	Directive	July 18, 2014	D-GA 2014-03	Compressed Natural Gas Fueling Site Requirements	This directive clarifies requirements for compressed natural gas dispensing equipment installations and operation. Prior to installation of these fueling stations the owner or representative must apply for a Design Registration to have the equipment and site design accepted before installation work commences.
Gas	Directive	July 18, 2014	D-GA 2014-04	Appliance Air Intake Clearance From Regulator / Over Pressure Relief Device Vent Outlet	This directive defines minimum clearance requirements for appliance air supply inlets (combustion air) in order to resolve installation related conflicts in the province.
Gas	Directive	September 23, 2014	D-G5 051206 7 Revision 02	Retail Propane Refueling Stations	Update of directive which details the requirements for the design, installation and operation of retail propane refueling stations in accordance with B149.2 Propane Storage and Handling Code.
Gas	Directive	November 14, 2014	D-GA 2014-05 Revision 01	Obsolete Gas Appliance Replacement Parts - Components	This directive addresses the installer's responsibility to ensure that replacement parts do not alter any gas appliance beyond what is permitted in section 66 of the *Safety Standards Act* (SSA) and that the appliance meets the original certification standard after repair.

Appendix D Regulatory Instruments & Amendments
Continued

Table D-1: Listing of Regulatory Instruments and Amendments

INDUSTRY SECTOR	INSTRUMENT TYPE	ISSUE DATE	DOCUMENT Nº.	TITLE	DESCRIPTION
Gas	Directive	November 18, 2014	D-G5 051201 2 Revision: 04	Approved Certification Marks for Gas Appliances	This directive specifies the certification/approval marks that are acceptable in BC.
Boilers, Pressure Vessels and Refrigeration	Directive	January 30, 2014	D-BP 2014-01	Application For Third Class Power Engineer's Certificate of Qualification	This directive was issued to provide the correct interpretation of the Power Engineers, Boiler, Pressure Vessel and Refrigeration Safety Regulation with respect to the types of work experience that is acceptable as counting toward firing time requirements in the regulation. When an applicant is working in a first or second class power plant.
Boilers, Pressure Vessels and Refrigeration	Directive	December 11, 2014	D-B6 070101 1 Revision 4	Incident reporting requirements with respect to the Boiler, Pressure Vessels and Refrigeration technology	This directive is being issued to clarify the requirements for the reporting of incidents to the Safety Authority. It is issued with respect to the requirements of the *Safety Standards Act*, the Safety Standards General Regulation and the Power Engineers, Boiler, Pressure Vessel and Refrigeration Safety Regulation.
Electrical	Information Bulletin	February 25, 2014	B-E3 071019 3 Revision 05	Approved Certification Marks For Electrical Products	This information bulletin was updated to reflect the certification marks that are acceptable in BC under section 21 (1) of the Electrical Safety Regulation.
Electrical	Information Bulletin	April 28, 2014	IB-EL 2014-01	Load Calculations for Row-Housing – Rule 8-200 (2) (Duplexes, Triplexes, Quadruplexes, Townhouses and Single Family Dwellings with a Secondary Suite)	This information bulletin provides clarity with respect to the calculation of minimum ampacity of service or feeder conductors from a main service supplying two or more dwelling units.
Elevating Devices	Information Bulletin	January 8, 2014	B-L4 110803 4 Revision 1	Elevating Devices Internal Cab Modernization	Reissue of information bulletin which notifies that all internal cab modernizations will be specified as minor alterations that will require professional engineering review and stamp. In addition to the technical submission the attached Internal Cab Modernization Data Sheet must be completed and signed by the professional engineer. Alterations shall comply with the applicable requirements of the B44 Code, Directive D-L4 110803 5 and the Acts & Regulations.
Elevating Devices	Information Bulletin	February 17, 2014	IB-ED 2014-01	Vendor Supplied Machine Room quipment Guarding	This information bulletin informs owners of elevating devices that addition of vendor or original elevator manufacturer supplied machine equipment guarding must meet all applicable requirements. This includes design registration as a minor alteration and that access for maintenance contractors and BC Safety Authority safety officers must not be thwarted by the installation.
Elevating Devices	Information Bulletin	March 18, 2014	IB-ED 2014-02	Changes to Elevating Booking Procedures and General Contractors and Owner's Checklist	This information bulletin provides notice to contractors and owners that changes to the foregoing procedures and checklists have take place. Links to detailed websites are provided.
Gas	Information Bulletin	February 03, 2014	IB-GA 2014-01	Pipe Welding Requirements for Gas Installations	This information bulletin reminds persons that the Natural gas and Propane Code, as adopted in BC, requires welders of gas piping to be qualified as pressure welders in accordance with the Power Engineers, Boiler, Pressure Vessel and Refrigeration Safety Regulation.
Gas	Information Bulletin	July 24, 2014	B-G5 051206 4 Revision 2	Clearance to Regulator / Over Pressure Relief Device	Reissue of information bulletin which illustrates the most typical clearance requirements for regulator/over pressure relief devices as indicated in Table 5.2 of the adopted CSA B149.1 Natural gas and Propane Installation Code.
Gas	Information Bulletin	November 14, 2014	B-GA 2014-02	Assembly of Canadian Certified Portable Natural Gas & Propane Barbeques / Appliances	This information bulletin is intended to explain the requirements when completing the final assembly of an approved portable gas barbeque or a similar type of gas appliance.
Boilers, Pressure Vessels and Refrigeration	Information Bulletin	April 9, 2014	IB-BP 2014-01	Boiler and Pressure Vessel Codes Adopted	This information bulletin announces the adoption in BC, by Ministerial Order M102, of new editions of several technical codes under the Power Engineers, Boiler, Pressure Vessel and Refrigeration Safety Regulation effective April 3, 2014.
Boilers, Pressure Vessels and Refrigeration	Information Bulletin	September 2, 2014	IB-BP-2014-02	Design Registration – Changes to the Safety Authority's Application Process	This information bulletin is issued to inform clients of changes to the application process for the registration of boiler, pressure vessel, pressure fitting and pressure piping designs.
Boilers, Pressure Vessels and Refrigeration	Regulatory Amendment	-	-	-	B.C. reg. 47/2014 came into force on April 3, 2014. The regulation amends the Schedule to the Power Engineers, Boiler, Pressure Vessel & Refrigeration Safety Regulation in order to adopt the latest editions of several technical boiler codes and standards.
Elevating Devices	Regulatory Amendment	-	-	-	M 441 (B.C. reg 239/2014) deposited December 16, 2014. The regulation amends the Elevating Devices Safety Regulation in order to provide for the Elevating Device Mechanic Certification Program.

Stakeholder Engagement

Appendix E

Working Groups, issue-specific consultations, Associations and National Codes and Standards Committees

Table E-1: Working Groups – Technology Advisory Committees

ISSUE TYPE	ISSUE	TECHNOLOGY	STATUS
Technical Safety, Regulatory Improvement and Service Delivery	Waterslides	Amusement Devices	Active
Technical Safety, Regulatory Improvement and Service Delivery	Ziplines	Amusement Devices	Active
Regulatory Improvement	Review of 2015 edition of the Canadian Electrical Code	Electrical	In formation
Service Delivery	Defining requirements for the recognition of an electrical training program by the Provincial Safety Manager	Electrical	Completed (October 2014)
Service Delivery	Review of Annual Operating Permit process	Electrical	Active
Technical Safety	Review of Electrical Safety Regulation section 18	Electrical	Completed (January 2014)
Technical Safety	Apprenticeship review in preparation for red seal for gasfitters	Gas	Inactive
Regulatory Improvement	Gas Safety Regulation review	Gas	In formation
Regulatory Improvement	Review of requirements for limited gas product approvals (File 25)	Gas	Completed (November 2014)
Regulatory Improvement	Review of maintenance, operation and administration requirements for small gas distribution systems	Gas	Active
Regulatory Improvement	Gas Field Safety Representatives	Gas	Active
Service Delivery	Gasfitter bursary	Gas	Completed (September 2014)
Regulatory Improvement	Power Engineers, Boiler, Pressure Vessel and Refrigeration Safety Regulation review	Boiler	In formation
Technical Safety	Quality control manuals for refrigeration contractors using steel piping	Boiler	In formation
Service Delivery	Education (Sub-Committee)	Boiler	In formation
Technical Safety	Technical safety issues for refrigeration contractors (Sub-Committee)	Boiler	Active
Technical Safety	Emergency Operations	Elevating Devices	In formation
Technical Safety	Private Residences Elevating Devices	Elevating Devices	In formation
Regulatory Improvement	Review of CSA B44-13 Code	Elevating Devices	Active
Technical Safety	Mitigating risks for aging ropeways in BC	Passenger Ropeways	Active
Technical Safety	Certification of passenger ropeway maintenance personnel	Passenger Ropeways	Active
Service Delivery	Governance of Technology Advisory Committees	All	Active
Technical Safety and Regulatory Improvement	Inter-Technology issues	All	Active

Appendix E Stakeholder Engagement Continued

Table E-2: Issue-Specific Consultations

ISSUE TYPE	ISSUE	TECHNOLOGY	STATUS
Service Delivery	Fee increases and changes for 2015-2017	Electrical / Gas / Elevating Devices / Boilers, Pressure Vessels & Refrigeration	Completed (September 2014)

The following table outlines the industry associations as well as national codes and standards committees that BCSA employees current sit as active committee members (for the period of January 1 to December 31, 2014).

Table E-3: Associations/National Codes and Standards Committees

TECHNOLOGY	ASSOCIATIONS / NATIONAL CODES AND STANDARDS COMMITTEES
Amusement Devices	• ASTM F24 – F24.80 Canadian Task Force (Co-Chairman) • NAARSO (National Association of Amusement Ride Safety Officials)
Boilers, Pressure Vessels and Refrigeration	• International Pressure Equipment Integrity Association (IPEIA) • Association of Chief Inspectors Technical Committee (ACI TC) • Association of Chief Inspectors annual meeting (ACI) • CSA B51 Code Committee • CSA B52 Code Committee • ASME Conference committee • National Board of Boiler Inspectors General Meeting • Standardization of Power Engineers Examination Committee (SOPEEC) • Interprovincial Power Engineering Curriculum Committee (IPECC)
Electrical	• Committee on Canadian Electrical Code Part I – CSA • ULC Advisory Council • CSA Z460 • Canadian Electrical Code Part 4 – CSA • Canadian Advisory Council on Electrical Safety (CACES) • International Association of Electrical Inspectors (IAEI) • BC Electrical Association (Member, Board of Directors)
Elevating Devices	• CSA B355 Lifts for Persons with Physical Disabilities Safety Code • CSA B44.1/ASME A17.5 Elevator & Escalator Electrical Equipment Standard • CSA Z185 for Personnel Hoists • CSA B44/A17 Elevator Safety Code • Association of Provincial Chief Elevator Inspectors • APEGBC Building Codes Committee • ASME A17 Standards Committee for Elevators and Escalators
Gas	• CSA B149.1 Code Committee • CSA B149.2 Code Committee • CSA B149.3 Code Committee • CSA B149.5 Code Committee • CSA B149.6 Code Committee • BC Common Ground Alliance • Canadian Propane Association BC Committee • Examination Requirements for Alternative Fuel Certification • Interprovincial Gas Advisory Council • CSA Z247 Standard Damage Prevention for the Protection of Underground Energy and Utility Networks • CSA Z276 Technical Review Committee
Passenger Ropeways	• CAN/CSA Z98 Technical Committee (Vice Chair) • Canada West Ski Areas Association • International Meeting of Technical Supervisors in Ropeway Engineering (ITTAB)
Railways	• Advisory Council on Railway Safety (Canada) • Western Provincial Railway Safety Committee • Federal / Provincial Working Group on Railway Safety (Canada) • BC Provincial Committee of Rail Safety Public Outreach (Co-Chair)

Client Education Program

Appendix F

Education Activity Descriptions

- Tech Talks: presentations and supporting documents that educate client groups about specific technical risks and issues
- Carbon Monoxide – Targeted Incident Reduction: a targeted public awareness program aimed at specific groups that are at risk of carbon monoxide poisoning or death
- Think Permit: a public awareness program targeted at homeowners doing or planning home renovations involving regulated gas and/or electrical work
- Elevating Devices Mechanics Certification: a client awareness program that promotes the requirements of the new Elevating Devices Mechanics Certification program
- Panel Discussions – Events where segments of various industries, non-profit organizations, institutions and other entities have a chance to ask our employees questions about technical risks and safety

Program Activities Defined

- Direct Reach: the number of clients, their employees, or members of the public reached directly by members of BCSA through targeted program activities (i.e. Tech Talks, conferences, forums, panels or other outreach events)
- Activities: all forms of outreach used in support of education programs, including face-to-face, print media and online (i.e. Tech Talk sessions, print ads in targeted publications, web ads)
- New Development: number of new program deliverables developed (i.e. new Tech Talks, new program materials)
- Media: number of media resources developed (videos, online games, radio commercials, etc.)
- Collaborations: number of industry groups that collaborated with BCSA to deliver education programs (i.e. CPA on the propane decals for the 20lb cylinders)

Formal Client Education in 2014

Table F-1: Electrical

TITLE/TOPIC	DESCRIPTION	QTY. OF PARTICIPANTS
2012 Electrical Code Changes	This series of Tech Talks guides participants through the key changes in the 2012 BC Electrical Code. Reviewed section by section, the talks highlight changes from CSA and BC Amendments. The presentation is offered in 4, approximately 2 hour modules and in some cases it is available in one day. Contractors and others will find the section 4, conductor ampacity changes, substantially change installation requirements. There is also an entirely new section 84, Renewable Energy Systems.	20
Certification Requirements for Manufactured Homes and RV's	This talk is oriented toward professionals (i.e. real estate agents) who deal with the disposal and sale of these homes, and electricians and electrical contractors who work on manufactured homes. Topics include applicable regulations and directives, the seller's responsibilities in the transaction, the process for obtaining BCSA approval for wiring, and requirements and processes for equipment labels.	30
Generators	This talk covers codes and regulations that apply to installation, maintenance and testing of generator systems, and other general requirements for these systems. Specific topics include loading and sizing, transfer switches, grounding and bonding, and applicable wiring methods.	60
60 Things Every Electrician Should Know	Electrical Contractors knowledge quiz and follow up discussion on answers.	44
WFMA Lunch & Learn (Operating Permits)	Talk on Operating Permits given to the Whistler Facilities Managers Association.	20
CAHPI BC Conference - Electrical Tech Talk	Canadian Association of Home and Property Inspectors were given a Tech Talk on electrical safety risks to look for in site inspections, and fielded many questions later from inspectors on various topics.	50
Barn Wiring		92
Introduction to BCSA	This talk is designed to provide an overview of BC Safety Authority – for various apprentices and clients new to their profession or new to BC.	67
New Electrical Contractors Breakfast	Early morning breakfast with various speakers presenting what BCSA does – focused for new contractors.	25
My Connection Breakfast	Early morning breakfast with a facilitated presentation on improvements made to MyConnection.	60
Northern Tail Gate Open House	Open house to welcome clients and familiarize themselves with BCSA employees, various topics discussed.	75
LMN Open House	Open house to welcome clients and familiarize themselves with BCSA employees, various topics discussed.	45
Innovative and Sustainable Electrical Energy Conference	Conference with business partners where the topics of discussion range across ideas for sustainable energy as it pertains to the electrical industry.	90

Appendix F Client Education Program Continued

Formal Client Education in 2014 Cont'd

Table F-2: Boiler

TITLE/TOPIC	DESCRIPTION	QTY. OF PARTICIPANTS
Welder Qualifications	Requirements of BCP 100 with welding instructors.	2
Welding Procedures	Weld repair requirements and confined space work requirements related to pressure vessels.	26
Refrigeration regulations, codes & standards	Review of refrigeration codes and standards.	9
Alterations & Repairs	Safety risks associated with specific alterations & repairs.	6
Introduction to BCSA (PE)	This talk is designed to provide an overview of BC Safety Authority – for various apprentices and clients new to their profession or new to BC.	8
Prescriptive Regulation (Shell Calgary)	Presentation to Shell Canada Operations on BC prescriptive regulations and how they differ from Alberta & what to expect for permitting and inspections etc…	10

Table F-3: Gas

TITLE/TOPIC	DESCRIPTION	QTY. OF PARTICIPANTS
Introduction to BCSA: Fitters	This talk is designed to provide an overview of BC Safety Authority for 4 year Gas Fitter students. Specific topics include the role of the safety officer, expectations of gas professionals and the RAP program.	28
Plastic Venting	Provides further information in regards to gas appliances approved with Special Venting Systems using plastic materials.	6
Introduction to BCSA: JARTS	This talk is designed to provide an overview of BC Safety Authority for Refrigeration Apprentices.	30
Design Registration	Talk focused on the process to have gas designs registered with BCSA.	50
Fairs & Festivals / Food Carts	Talk focused on permitting and inspection requirements for mobile food carts at fairs and festivals.	45
My Connection Breakfast	Early morning breakfast with a facilitated presentation on improvements made to MyConnection.	15
Gas Online Forum	Topics can vary for this forum.	6
Navigating Education Pipelines in the Gas Industry Conference	Conference with business partners where the topics of discussion range across ideas on pipelines in BC and regulatory & industry requirements.	100

Table F-4: Railway

TITLE/TOPIC	DESCRIPTION	QTY. OF PARTICIPANTS
Online Town Hall Forum	Topics can vary for this forum.	4

Table F-5: Multi-Technology Events

TITLE/TOPIC	INDUSTRY SECTORS (TECHNOLOGIES INVOLVED)	DESCRIPTION	QTY. OF PARTICIPANTS
Co-operative Housing Federation of British Columbia Education Conference Panel	Electrical, Gas, BPVR, Elevating Devices	BCSA sent a panel of employees to sit on the Co-operative Housing Federation of British Columbia Education Conference to discuss various safety risks that can be encountered in their particular residences. Involved Gas, Electrical, Elevating and Boiler Technologies.	27
Gas Panel - Boiler Permitting Requirements	Gas, BPVR	Joint panel discussion on boiler and gas permit requirements and where they overlap.	15

Media Relations Actions

Appendix G

During the period January-December 2014, BC Safety Authority took the following media relations actions to raise awareness of safety hazards and reduce risk and to provide comment and context to safety issues that were of interest to the media.

Table G-1: Media Relations Actions

DATE OF ACTION	TITLE/TOPIC	ACTION	INDUSTRY SECTOR	SYNOPSIS
Jan. 10	Babine investigation	Statement	Electrical, Gas	BCSA released statement following Crown Counsel's announcement that no charges will be approved against Babine Forest Products.
Jan. 15		Media response	Electrical, Gas	BCSA communications provided response to The Globe & Mail regarding BCSA's role in the Babine incident investigation.
Jan. 16		Media response	Electrical, Gas	BCSA communications responded to a Vancouver Sun request for information regarding BCSA's Babine incident investigation report.
Jan. 16		Media Release	Electrical, Gas	BCSA released News Release with link to its full investigation report into 2012 Babine Forest Products sawmill explosion.
Jan. 22		Media response	Electrical, Gas	BCSA communications responded to a Business In Vancouver request for information regarding BCSA's Babine investigation report.
Mar. 26		Media response	Electrical, Gas	BCSA communications responded to an OHS Canada Magazine request for information regarding BCSA's role in the investigation and actions undertaken to promote safety.
Jan. 13	BCSA announces 2014 changes to Board of Directors	Media Release	Corporate	BCSA communications posted an announcement of a new chair and four new members of BCSA's Board of Directors.
Jan. 13	Safe home renovations and improvements	Media response	Electrical, Gas	BCSA communications responded to a Canadian Press request for information regarding safe home renovations and improvements and directed reporter to ThinkPermit.ca.
Jan. 23	Sprinkler systems	Media response	Non-BCSA	BCSA communications responded to a CBC request for information regarding sprinkler systems in relation to the building code.
Jan. 24	2011 North Vancouver Winter Club ammonia incident	Media response	BPV	BCSA communications responded to The Province request for clarification regarding a previous BCSA media statement regarding the cause of an ammonia incident in 2011.
Jan. 20	Zipline safety	Media response	AD	BCSA communications responded to a CBC request for information regarding BC regulations for ziplines.
Jan. 30		Media interview	AD	BCSA AD safety manager provided on-camera interview for CBC Marketplace regarding BC regulations and enforcement for ziplines.
Jan. 30	Escalator safety	Media response	ED	BCSA communications responded to a CBC request for information on escalator injuries/deaths and BC elevating regulations.
Feb. 04		Media interview	ED	BCSA communications provided on-camera interview and elevator safety information to Global National.
Feb. 11		Media interview	ED	BCSA communications provided live interview and elevator safety information to CFAX Radio.
Feb. 05	Sea to Sky gondola incident	Media response	PR	BCSA communications responded to a News1130 inquiry regarding BCSA's role in the investigation.
Feb. 06		Media response	PR	BCSA communications responded to a Global News request for information regarding PR regulations and the investigation process.
Feb. 06		Media response	PR	BCSA communications responded to a CBC request for information regarding the investigation.
Feb. 11		Media response	PR	BCSA communications responded to a Squamish Chief request for an update on the investigation on the gondola operations.
Feb. 20		Media response	PR	BCSA communications responded to a CKNW request for an update on the investigation.
Feb. 21		Media response	PR	BCSA communications responded to a Georgia Straight request for an update on the investigation.
Feb. 28		Media response	PR	BCSA communications responded to a Squamish Chief request for an update on the investigation.

Appendix G Media Relations Actions Continued

Table G-1: Media Relations Actions

DATE OF ACTION	TITLE/TOPIC	ACTION	INDUSTRY SECTOR	SYNOPSIS
Feb. 07	FOI request	Media response	Corporate	BCSA responded to an FOI request from Vancouver Sun related to salary listings.
Feb. 14	Propane depot regulation	Media response	Gas	BCSA communications responded to a CBC request for information regarding propane depot regulations.
Mar. 01 - Mar. 07	Crystal Mountain incident	Media response	PR	BCSA communications and PR safety manager provided response and interviews to multiple media organizations.
Mar. 06		Statement	PR	BCSA communications posted a written statement and audio statement from PR safety manager on the investigation.
Mar. 13	Gas and electrical equipment safety in floods	Media release	Electrical, gas	BCSA communications released electrical and gas equipment safety tips for flood-prone areas. An audio recording of the regional business leader providing the tips was also posted online.
Mar. 17		Media response	Electrical, gas	BCSA communications responded to a Global BC request.
Mar. 31	Apex incident	Media response	PR	BCSA communications responded to inquiries from Global BC and Castanet regarding a chairlift fire at Apex report in Penticton by providing updates on the incident investigation.
Apr. 8	Island railway	Media response	Railways	BCSA communications provided clarification to Comox Valley Record re: status of railway proposal.
Apr. 10	Combustible dust	Media response	Electrical, Gas, BPV	BCSA provided photos and background to a Canadian Forest Industries article on wood dust.
Apr. 14	Lakeland Mills Investigation Report	Media release	Electrical, Gas, BPV	BCSA released investigation report on 2012 Lakeland Mills sawmill incident.
Apr. 25	State of Safety Report	Media release	All	BCSA released 2013 State of Safety Report.
Apr. 29	Cottage Life Magazine Article	Media response	PR and ED	BCSA provided information about regulations and safety considerations related to trams and inclined lifts used as beach access for cottages.
May 7-8	Single bottom cylinder elevators	Article	ED	BCSA provided content to CHOA for article in The Times Colonist (May 7) and The Province (May 8) on single bottom cylinder safety order.
May 8		Article	ED	BCSA communications submitted an article for the CHCA Journal on the single bottom cylinder safety order.
May 9	Sea to Sky Gondola	Media release	PR	BCSA communications issued release announcing that BCSA had granted full unrestricted operating permit for Sea to Sky Gondola.
May 13	Combustible dust	Media response	Electrical, Gas, BPV	BCSA communications provided contextual information to Global TV "16x19" program on dust explosions.
May 13	Fire safety equipment	Media response	Electrical	BCSA communications provided context to a CHEK news story about fire safety and retrofitting older buildings to current code.
May 23	2013 Annual Report	Media release	All	BCSA released 2013 Annual Report.
May 30	Equipment safety in floods	Media release	Electrical, Gas	BCSA communications issued a media release on gas and electrical equipment safety in floods.
June 6 & 9	Sea to Sky Gondola	Media response	PR	BCSA communications responded to media inquiries related to the incident investigation.
June	ASA for Oil and Gas Report	Article	Electrical, Gas, BPV	BCSA communications published an article in the Oil and Gas Report along with an advertisement promoting ASAs.
July 2	Food truck safety	Media response	Gas	BCSA communications responded to CTV-Vancouver Island enquiry regarding food truck gas safety, following a propane explosion in Philadelphia.
July 9	Kin Race Track	Media response	Electrical	BCSA communications responded to Global News enquiry re: our role in the disconnection of power at a Vernon race track.
July 14	Playland ride safety	Media response	AD	BCSA communications responded to a Province newspaper enquiry re: a complaint regarding rider safety on a Playland ride.
July 31	Sea to Sky Gondola	Media response	PR	BCSA communications responded to media inquiry related to the incident investigation.
Aug. 5	CSA standards for manufactured homes	Article	Electrical	BCSA communications provided input on an article for the BC Real Estate Council newsletter about CSA labels in manufactured homes.

Table G-1: Media Relations Actions

DATE OF ACTION	TITLE/TOPIC	ACTION	INDUSTRY SECTOR	SYNOPSIS
Aug. 15	Wildfire safety	Media release	Gas and Electrical	BCSA communications prepared a media release on gas and electrical safety in support of communities facing wildfire threats. Not released, as fires were contained.
Aug. 18	Unregulated elevating devices	Media response	ED	BCSA communications responded to media enquiries from Global BC and Coast FM regarding an incident involving an unregulated elevating device in Langdale.
Aug. 18	RV propane explosion	Media response	Gas	BCSA communications spokesperson provided on-camera interview to CTV regarding gas safety following a Port Coquitlam RV explosion.
Sept. 4	Annual appliance maintenance	Article	Gas	BCSA communications provided background information for an article in the October 2014 issue of Heating Plumbing Air Conditioning Magazine.
Sept. 13	Crystal Mountain chairlift investigation	Media response	PR	BCSA communications spokesperson provided commentary for television, radio and print media on follow-up to the spring 2014 Crystal Mountain deropement incident.
Sept. 19		Media release	PR	BCSA communications issued update on incident investigation at Crystal Mountain Resort
Sept. 16	LED sign retrofitting	Article	Electrical	BCSA communications provided information about LED retrofitting requirements for a Sign Media article.
Sept. 24	Passenger Ropeways	Media response	PR & AD	BCSA communications provided information in response to a media inquiry from The Squamish Reporter about BCSA processes around passenger ropeways and amusement devices under the Elevating Devices Safety Regulation.
Sept. 29	Safe digging	Media response	Gas	BCSA gas safety manager provided a taped radio interview for CJCI vista radio in Prince George on identifying gas lines for safe excavation, "call before you dig".
Sept. 30	Carbon monoxide	Media release	Gas	BCSA communications issued a media release regarding the dangers of carbon monoxide as temperatures fall in BC.
Oct. 6	E&N Rail	Media response	Rail	BCSA responded to CTV and CFAX 1070 enquiries re: the E&N rail line on Vancouver Island and safety concerns.
Oct. 14	Gondola Doors	Media response	Passenger ropeways	BCSA responded to an enquiry from Pique magazine Re: the doors on Whistler Blackcomb's gondolas.
Oct. 20	New BCSA CFO	Media release	All	BCSA welcomes Brian Simmers as new CFO
Oct. 31 – Nov. 6	E&N Rail	Media response	Rail	BCSA responded to CTV, Focus Magazine, and Nanaimo Daily News enquiries re: the E&N rail line corridor on Vancouver Island and safety concerns. The role of BCSA, VIA rail, and Southern Railway of Vancouver Island Ltd.
Nov. 24	Crystal Mountain	Media response	Passenger Ropeways	BCSA responded to media enquiry from Global re: Crystal Mountain incident report to be released in early 2015.
Nov. 5	Flooding	Media release	Gas and Electrical	BCSA locally distributed flood safety information for the Vancouver North shore area.
Nov. 14 - 15	Sea to Sky Gondola – Incident Investigation Report	Media release	Passenger Ropeways	BCSA posted an incident investigation report re: Sea to Sky Gondola.
		Media response		BCSA responded to interview requests from News 1130 and the Squamish Chief re: Sea to Sky report.
Nov. 19	Ski lift safety	Media release	Passenger Ropeways	BCSA reminds skiers and boarders to stay safe on chairlifts this winter.
Nov. 27	Holiday light safety	Media release	Electrical	BCSA sheds light on safe holiday decorating.
Dec. 3	Carbon Monoxide Safety	Media response	Gas	BCSA responded to media enquiries from CTV Nanaimo, Global News and CBC re: CO safety related to local incident.
Dec. 4	Furnaces	Media response	Gas	BCSA responded to media enquiries from the Vancouver Sun re: furnace repairs and qualified workers.
Dec. 10	Hot water heater installation safety	Media response	Gas	BCSA provided input for a CKNW Home Discovery Show segment regarding installation requirements for propane-fueled on-demand hot water systems.
Dec. 17	EDMC program announcement	Industry release / web posting	Elevating	BCSA introduces certification program for elevating devices mechanics.
Dec. 18	Education initiative with UVic	Article	Passenger Ropeways	BCSA provided information in support of an article in the University of Victoria newspaper related to educational involvement with engineering students.

Appendix H Local Government Administration

of the *Safety Standards Act*

The Province of British Columbia has delegated partial administration of the *Safety Standards Act* to a number of local governments.

Local governments that have administrative responsibility for the electrical technology:

- City of Burnaby
- City of North Vancouver
- City of Surrey
- City of Vancouver
- City of Victoria
- Corporation of the District of Maple Ridge
- District of North Vancouver
- Municipality of West Vancouver

Local governments that have administrative responsibility for the gas technology:

- City of Burnaby
- City of Kelowna
- City of North Vancouver
- City of Richmond
- City of Vancouver
- Corporation of the District of Maple Ridge
- District of North Vancouver

Local governments that administer gas assessment programs for detached dwellings with gas services at a pressure of 14.0 kPa gauge or less as well as other buildings with gas services at a pressure of 14.0 kPa gauge or less with a total connected load for the meter of 120 kW or less.

Technical Risk Register

Appendix I

INDUSTRY SECTOR	RISK RATING	RISK	DESCRIPTION
Boiler Pressure Vessels and Refrigeration	1	**Equivalent Standards Agreements (ESA) Management.**	Some units under the ESA are being installed without registration or first certification.
	2	**Contractor License Renewal.**	Licensed contractors are receiving annual renewal without an audit of their quality management systems.
	3	**Ice Skating Facilities.**	Recreational ice skating facilities may be operating without required staffing levels or being registered as special status plants.
	4	**Release of Ammonia from refrigeration plants.**	Inhalation of ammonia gas released from refrigeration plants may result in personal injury to workers.
Electrical	5	**Unpermitted Homeowner Work.**	Unpermitted homeowner work is not inspected or the risk is not controlled.
	6	**EL Operating Permits - Low Market Penetration.**	Owners operating electrical systems may not be complying with safety and permitting requirements.
	7	**Untrained individuals performing electrical work.**	Unqualified or inadequately trained individuals are performing electrical work.
	8	**Explosion hazard areas with combustible wood dust.**	Explosion may occur where electrical equipment is located in areas with hazardous levels of combustible wood dust.
	9	**Field Safety Representatives (FSR) Code Knowledge.**	Potential unsafe practices by FSR due to their lack of up-to-date knowledge of codes and standards.
Elevating	10	**Safety Tests.**	Elevating safety impacted because the permit holders (owners and contractors) do not perform required safety tests in the required code and frequencies.
	11	**Hydraulic Elevator Controller.**	Hydraulic Elevator Controller may fail to regulate the release of pressure resulting in rapid descend while the car is in inspection mode.
	12	**Single Bottom Cylinder.**	Single bottom cylinder elevators may result in catastrophic incidents.
	13	**Elevating Mechanic Certification Process.**	Elevating mechanics are not certified. There are no standards for education and examination requirements.
	14	**Vacancies created by Safety Officers retiring from the BCSA.**	Ability to attract competent Elevating Safety Officers to BCSA to replace those who will be retiring in 3 to 5 years.
Gas	15	**Underground Gas Line Hits.**	Homeowners and contractors may damage underground gas pipes.
	16	**Unsafe handling of Gas Equipment by the public.**	Public may not operate gas equipment safely (for example, propane cylinders, boilers and furnaces).
	17	**Unpermitted Small Utilities.**	Small utilities (for example, strata corp., and residential sub-division) may not have valid operating permits.
	18	**Regulator Over Pressure Relief Discharge Clearances Not Maintained.**	Regulator over pressure discharge does not meet clearance from openings, intakes, outlets and ignition sources as required by Code.
Passenger Ropeways	19	**Lack of operational data available to predict the effect of wind.**	Inadequate data obtained to inform procedure.
	20	**Improper By-Pass Procedure**	Use of jumper wires and other methods to by-pass safety functions.
	21	**Lack of formal training for Passenger Ropeways Technicians.**	Public safety may be affected because of formalized training and recognized certification for Passenger Ropeways (PR) Technicians does not exist.
Railways	22	**Railway Program Jurisdiction Clarity.**	Lack of clarity in legal responsibility and authority between BCSA and the Provincial Government.
	23	**Railway Trespass.**	Threats to public safety arising from trespassing on railway lines.
	24	**Unregulated Sidings and Spurs.**	Lack of regulatory control on private sidings and spurs.
	25	**Lack of training oversight of employees.**	Inadequate training of employees in safety critical positions working on provincial industrial railways by the operators.

Appendix J Glossary

Assessment - An evaluation or review of information relating to regulated work or equipment. Key BCSA activities in Assessment are:

- gathering of evidence through on-site or physical assessments (of reported hazards and work performed by contractors or homeowners);
- gathering of evidence through incident investigations;
- reviews of permit applications and submitted or accepted declarations;
- audits or documentation evaluations (of safety management plans for example);
- reviews of qualifications for licensing or certification; and
- reviews of products and designs when approving these for use in BC.

Assessment/Inspection Outcomes

Pass - The safety officer has assessed that the regulated work and/or regulated product was found to comply with the *Safety Standards Act*, regulations and/or applicable technical code(s).

Conditional pass - The safety officer has assessed that the regulated work and/or regulated product was found to NOT comply with the *Safety Standards Act*, regulations and/or applicable technical code(s). Further regulated work may only be undertaken as directed on the Certificate of Inspection, while the identified non-compliances are being corrected.

Fail - The safety officer has assessed that the regulated work and/or regulated product was found to NOT comply with the *Safety Standards Act*, regulations and/or applicable technical code(s). Further regulated work on the affected system or phase of work, and/or operation of the regulated equipment must not be undertaken until the identified non-compliances have been corrected.

Audit - A review focused on the system or process used by a duty holder to manage safety outcomes.

Certificate of inspection - A document issued by BC Safety Authority upon completion of an inspection. This document identifies any non-compliance with respect to the regulated work or regulated product that must be corrected by the permit holder.

Certificate of qualification - A certificate issued by BC Safety Authority to an individual who provides evidence of his/her knowledge and ability to do regulated work in a manner that meets the requirements under the *Safety Standards Act* and which allows an individual to perform regulated work in British Columbia within the scope of the certificate.

Compliance order - A document issued to a person or company by BC Safety Authority that specifies actions to be taken, stopped or modified where, in the opinion of BC Safety Authority, there exists a risk of personal injury or damage to property associated with work or products regulated by the *Safety Standards Act*.

Directive - A regulatory instrument that clarifies or provides new interpretation, application or operation of a regulation or code. Compliance is mandatory.

Discipline order - A document issued by BC Safety Authority to a person performing regulated work who:

- is in breach of a condition of, or restriction on, any licence or permission,
- practices in a discipline under the *Safety Standards Act* for which the contractor is not licensed or qualified,
- fails to comply with a compliance order or safety order
- fails to comply with a requirement, term or condition of an Alternative Safety Approach or,
- is convicted of an offense under the *Safety Standards Act*

Compliance with a Discipline Order is mandatory.

Duty holder - A person who is responsible for compliance because they either own or work on regulated equipment, products or assets according to the *Safety Standards Act*.

Incident - An event that occurred as a result of regulated work or equipment that either caused death, personal injury or damage to property, or created a risk of personal injury or damage to property.

Severe incident - An event that either caused or was likely to have caused fatal or permanent injury. Severe incidents may also be referred to as "Level 1" incidents.

Major incident - An event that either caused or was likely to have caused major injury and/or extensive property or equipment damage. Major incidents may also be referred to as "Level 2" incidents.

Minor incident - An event that caused or was likely to have caused minor injury and/or minor property or equipment damage. Minor incidents may also be referred to as "Level 3" incidents.

Note: incidents identified as UNDER INVESTIGATION were open at the time of report preparation. Information related to open investigations is subject to change and verification therefore discussion of these incident details is excluded.

Information bulletin - A document issued to provide helpful information and clarification on existing regulations or codes.

Injury - Any physical damage to the body caused by an event that occurs as a result of regulated work or equipment, further classified as:

Fatal injury - An injury causing death.

Major injury - An injury that involves long-term impairment of function or loss of function of any body part, organ or mental faculty, significant physical pain and some disability or loss of function; examples include fractures, internal injuries or wounds that are serious but may be not life-threatening, or considerable exposure to noxious substances. Medical attention is required.

Minor injury - A non-permanent injury that may require some medical or first-aid treatment; examples include lacerations, contusions, abrasions, or other injuries that have no residual effect. Further professional medical attention is not usually required.

Inspection - The same as a physical assessment, this is a review focused on the identification of unsafe conditions and compliance to prescriptive regulations or standards.

Appendix J

Installation permit - A permission that is required to install or alter a regulated product. An installation permit may be issued to a licensed contractor, a person who holds an operating permit, an owner of a regulated product or a homeowner who performs regulated work as permitted under the regulations.

Licence - A permission that allows a person, company or corporation to perform regulated work.

Monetary penalty - An administrative penalty levied by a safety manager in amounts up to a maximum of $100,000 to penalize non-compliant behavior.

Non-compliance - A failure of a regulated product or work to conform with applicable acts and regulations.

Operating permit - A permission issued by BC Safety Authority that allows the operation and maintenance of a regulated product. An operating permit may be issued to the owner of a regulated product or building where regulated work is to be performed.

Physical assessment - The same as an inspection, this is an assessment where the regulated product or work has been directly evaluated by BC Safety Authority.

Railway accident means an event that results in injury or damage relating to the railway's operations.

Railway classes - types of railways regulated by BC Safety Authority:

Common carrier railways transport passengers and/or goods and interchange common rolling stock with other railways.

Commuter railways exclusively provide rail transportation for passengers in or between urban and/or suburban locations.

Heritage railways operate or move only railway equipment of historical significance.

Industrial siding and spur railways exclusively serve and move railway equipment at industrial sites or as designated by the authority having administrative responsibility.

Industrial railways exclusively serve and move railway equipment through track switches at industrial sites or as designated by the authority having administrative responsibility.

Railway incident means an event where there is no damage or injury but the potential existed for either or both to occur and the cause is related to non-compliance with the approved rules, regulations, guidelines, policies or procedures of the railway or external events or activities beyond the control of the railway.

Reportable railway accident means an accident resulting directly from operation of rolling stock, where:

(a) A person sustains a serious injury or is killed as a result of
  1) being on board or getting on or off the rolling stock, or
  2) coming into contact with any part of the rolling stock or its contents; or

(b) The rolling stock
  1) is involved in a grade crossing collision, (all crossing accidents are reportable with or without injuries or fatalities)
  2) is involved in a collision or a derailment,
  3) sustains damage that affects its safe operation, or
  4) causes or sustains a fire or explosion, or causes damage to the railway that poses a threat to the safety of any person, property or the environment.

Reportable railway incident - An incident resulting directly from the operation of rolling stock where:

- a risk of collision occurs;
- an unprotected main track switch is left in an abnormal position;
- a railway signal displays a less restrictive indication than required for the intended movement of rolling stock;
- an unprotected overlap of operating authorities occurs;
- the movement of rolling stock exceeds the limits of its authority;
- there is runaway rolling stock;
- any crew member whose duties are directly related to the safe operation of the rolling stock is unable to perform the crew member's duties as a result of a physical incapacitation that poses a threat to any person, property or the environment; or
- any dangerous goods are released on board or from the rolling stock.

Safety order - A regulatory instrument issued to prevent or reduce the risk of personal injury or damage to property. Compliance is mandatory.

Safety Standards Administrators' Group – An advisory body comprised of representatives of the ten municipalities that administer the electrical or gas areas of the *Safety Standards Act* (See Appendix H). The Safety Standards Administrators' Group's role is to share safety information, standardize processes and interpretations, and ultimately to promote greater consistency in provincial safety management.

Sanction - A sanction is an administrative penalty levied by a safety manager to penalize non-compliant behaviour.

Technology Advisory Committee - A non-decision-making body comprised of volunteer industry representatives that has a role of identifying and advising BC Safety Authority on issues related to technical safety, regulatory change and service delivery.

Warning notice - A document issued to a person or company by BC Safety Authority identifying non-compliant behaviour and further advising that future non-compliance of a similar nature will result in progressive enforcement action.

Working group - A group of industry subject matter experts formed to address a specific safety issue, activity or project. Working Groups research, analyze and make recommendations on a specific safety aspect to their respective technology advisory committee and may be dissolved when the outcome is delivered.

Appendix K Contributors

The State of Safety Report represents one year of BCSA's safety-focused operations. Almost all employees contribute to the activities that are summarized and presented in the State of Safety Report. Safety officers author and conduct investigations and assessment reports. Client service representatives (CSR) administer the issuance of permits, licences and certificates of qualification. Senior safety officers and field service leaders review and guide the work of safety officers and CSRs as well as support content development for safety programs. Other employees of BCSA prepare the content for tech talks, organize education events, develop communications and newsletters or lead teams toward those efforts.

All research is exemplified by systematic investigation and study of materials and sources in order to establish facts and reach new conclusions. Beyond what is captured directly in this Report, individuals and organizations are regularly engaging in meaningful research in support of BCSA and the technical safety system. To this end, BCSA would like to recognize the contributions of Professor Peter Wild from the Department of Mechanical Engineering at University of Victoria and the first-year engineering cohort who explored design solutions for passenger ropeway deropements, and Andrea Palmer, fourth year engineering student from the University of British Columbia, who conducted various system analyses in support of BCSA's engineering department.

A team of employees directly contribute to the content and development of the State of Safety Report. These team members compile information related to their specialty and oversee its presentation in the Report. Those information owners are as follows:

REPORT CONTENT	INFORMATION OWNER	EMPLOYEE
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Overall report coordination	Research and Program Analyst	Stephanie Salido
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	Director, Safety Oversight	Janice Lee
Assessments and regulated work	Director, Operations and Service Excellence	Trent Wagner
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Client education	Leader, Business Improvement and Client Education	Paul Zabkar
Media relations	Director, Stakeholder Engagement and Communications	Quinn Newcomb
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	Boilers, Pressure Vessels and Refrigeration Safety Manager	Tony Scholl
	Gas Safety Manager	Brian Zinn
	Elevating Devices Safety Manager	Houssam Hamze
	Passenger Ropeways Safety Manager	Jason Gill
	Amusement Devices Safety Manager	Jason Gill
Railway safety program	Railway Safety Manager	Eric Samuelson
Alternative safety approaches	Safety Manager, Alternative Safety Approaches and Enforcement	Stephen Hinde
Historical incident summaries *(Carbon monoxide, ammonia and deropements)*	Research and Program Analyst	Stephanie Salido
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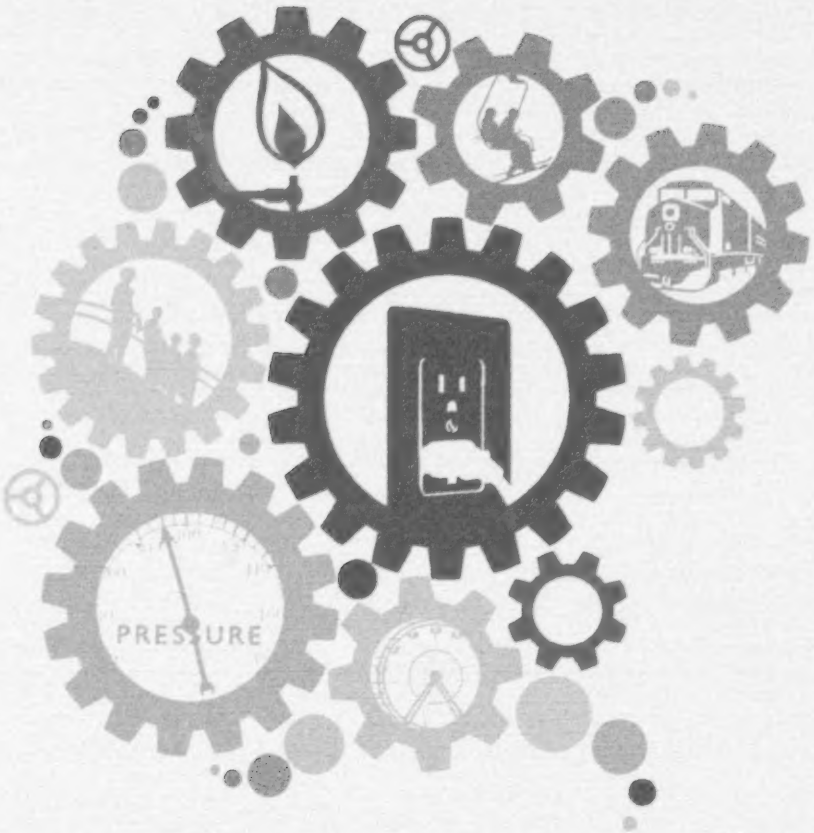

Safe technical systems. Everywhere.

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State of Safety Report 2014

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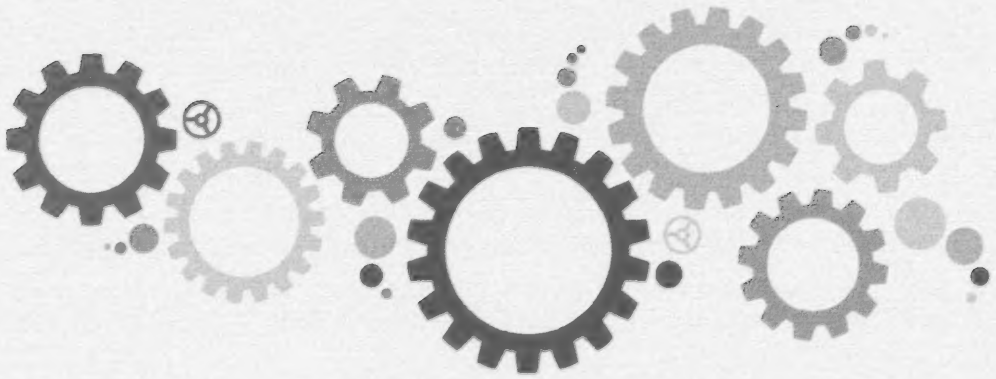

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